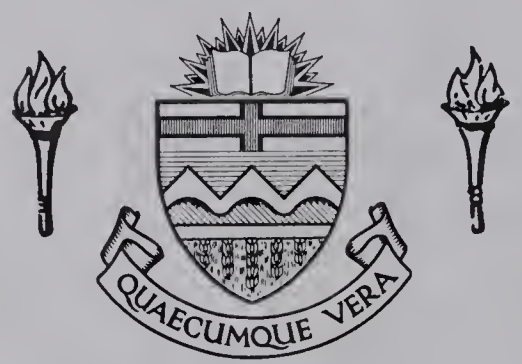
For Reference

NOT TO BE TAKEN FROM THIS ROOM

Ex libris
universitatis
albertaensis



For Reference

NOT TO BE TAKEN FROM THIS ROOM

The University of Alberta
Printing Department
Edmonton, Alberta

THE UNIVERSITY OF ALBERTA

AN ACADEMIC-ACHIEVEMENT ORIENTATION SCALE

by

© DANIEL J. PRECHT

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES

IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE

OF MASTER OF EDUCATION

DEPARTMENT OF EDUCATIONAL PSYCHOLOGY

EDMONTON, ALBERTA

OCTOBER, 1968

Thesis
1968 (F)
178

UNIVERSITY OF ALBERTA

FACULTY OF GRADUATE STUDIES

The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies for acceptance, a thesis entitled "An Academic-Achievement Orientation Scale" submitted by Daniel J. Precht in partial fulfilment of the requirements for the degree of Master of Education.

SHORTER ABSTRACT

This study explored the possibility of selecting items from the Kuder Preference Record which could be combined to form a measure of the degree to which an individual's motivation is directed towards academic activities.

Three samples of grade nine students made up of 135, 63 and 51 cases, and measures of academic achievement, ability, interests, socio-economic status and sex were used in the derivation and assessment of the proposed measure. The derivation of the scale was such that it yielded a relatively high correlation with average academic achievement but a low correlation with general intellectual ability.

It was found that the scale developed from the Vocational form tended to provide a better measure than did the scale from the Personal form and that the derived scales tended to yield higher correlations with achievement than did Kuder's original scales or combinations of his scales.

LONGER ABSTRACT

Using three samples of grade nine students, this study explored the possibility of deriving an academic-achievement orientation scale which employed preference items selected from the Kuder Preference Record. It was suggested that such a scale would measure the degree to which an individual's motivation is directed towards academic activities.

Separate scales were derived from two forms of the Kuder Preference Record, Vocational Form C and Personal Form A, using the main sample which consisted of 135 students and two criterion variables, average achievement in five academic subjects and general intellectual ability as measured by the Nonverbal form of the Lorge-Thorndike Tests of Intelligence. Factor analysis was used to assist in identifying items which had relatively high correlations with average achievement yet low correlations with general intellectual ability. Additional variables included in the study in order to assess the validity of the scales were achievement in individual academic subjects, scholastic ability as measured by the Verbal form of the Lorge-Thorndike Tests of Intelligence, original scales from the Kuder Preference Record, socio-economic status and sex. The two smaller samples, consisting of 63 and 51 students, were also included for the purpose of assessing the scales which had been derived from the main sample. These secondary samples were representative of high ability, high socio-economic status and low ability, low socio-

economic status students, respectively.

Conclusions resulting from the study, which were at times based on a preponderance of favorable tendencies rather than on statistically significant differences, included the following:

1. Kuder Preference Record items can be used to form a scale which measures academic-achievement orientation.

2. The scale developed from the Vocational form tended to provide a better measure of this orientation than did the scale from the Personal form.

3. Academic-achievement orientation is related to differences in achievement among levels of socio-economic status.

4. The derived scales tended to yield higher correlations with achievement than did Kuder's original scales or combinations of his scales.

On the basis of this study, it is suggested that much more extensive research be carried out with respect to the proposed scale. It is contended that such a measure could be a useful reference point in the study of nonintellective correlates of academic achievement.

ACKNOWLEDGMENTS

The writer wishes to express his gratitude to Dr. R. S. MacArthur, thesis chairman, for the guidance and assistance he provided throughout the duration of this study.

Appreciation is also expressed to Dr. H. W. Zingle and Mr. J. E. Gallagher for their helpful suggestions and for their individual contributions to the study. The writer is also grateful to each of the three members of the examining committee for the particular roles they played at earlier stages in his graduate program.

Acknowledgments are also made to the principals and teachers of the classes included in the samples of the study for their assistance and cooperation, to the writer's wife, Dianne, for the many hours she devoted to helping with the analysis of data and typing, and to members of the Division of Educational Research Services staff for suggestions and assistance with respect to the processing of the data.

TABLE OF CONTENTS

CHAPTER		PAGE
I	THE PROBLEM	1
II	THE KUDER PREFERENCE RECORD	8
	Construction	8
	Reliability	11
	Validity	14
	A Previous Academic Interest Scale	16
III	CRITERIA FOR DERIVATION AND ASSESSMENT	19
	Academic Achievement	19
	Ability	20
	Sex	24
	Socio-economic Status	26
IV	DESIGN OF THE STUDY	29
	Definitions	29
	Postulates	30
	Hypotheses	31
	Statistical Design	32
V	PROCEDURE AND PRELIMINARY RESULTS	37
	Data Collection	38
	Using the Test Scores	41
	Preliminary Results	43

CHAPTER PAGE

VI STATISTICAL RESULTS AND INTERPRETATION 48

Hypothesis I 48

Hypothesis II 52

Hypothesis III 52

Hypothesis IV 53

Hypothesis V 54

Conclusions 56

VII IMPLICATIONS 59

Implications for Theory and Practise 59

Implications for Research 62

REFERENCES 65

APPENDICES 69

APPENDIX A - Kuder Preference Record Face Sheet . . . 69

APPENDIX B - Summary of Factor Solution Using Vocational Items 70

Summary of Factor Solution Using Personal Items 73

APPENDIX C - Scoring Keys for Derived Scales . . . 76

APPENDIX D - Analysis of Covariance on Average Achievement Grouping by Socio-economic Status . . 80

APPENDIX E - Comparison of Derived Scales to Best Weighting of Kuder's Scales 83

LIST OF TABLES

TABLE		PAGE
I	INTERCORRELATIONS OF PREFERENCE RECORD SCALES . . .	10
II	RELIABILITIES OF KUDER PREFERENCE RECORD VOCATIONAL SCALES	12
III	SAMPLE SCORES ON NORMED VARIABLES	44
IV	CORRELATIONS FOR THE TENTATIVE ACADEMIC-ACHIEVEMENT ORIENTATION SCALES	51
V	CORRELATIONS BETWEEN PREFERENCE SCALES AND AVERAGE ACADEMIC ACHIEVEMENT	55

CHAPTER I

THE PROBLEM

"...the relationship between ability and academic performance is well documented, and the great majority of studies are no longer concerned primarily with demonstrating this finding. Rather, they attempt to improve predictions through the use of additional factors of a nonintellective nature." (Lavin, 1965, p. 22) It was proposed for this study that a scale consisting of interest items could be used as one of the nonintellective variables that would improve the prediction of academic achievement.

That the study of individual differences with respect to scholastic achievement has for many years been focused primarily on individual differences in mental ability and has only recently begun to include a closer look at other facets which might be related to this area of concern is probably a function of the degree of success connected with the various studies of correlates of scholastic achievement. That is, while studies of correlations between achievement and ability have generally enjoyed a rather high degree of success in terms of extracting reassuring correlation coefficients, studies searching for other correlates of scholastic achievement have not been so rewarding. Thus while research related to the first multiplied rapidly that connected with the latter remained relatively static.

One such area which, according to theory, should be correlated

with achievement but which does not yield the desired consistent and significant correlation coefficients when its measured scores are compared with those of scholastic achievement is that which is labelled motivation. While measures of ability are employed to ascertain whether or not an individual has the capacity to perform a certain task, to achieve, measures of motivation are required to assess the individual's desire to perform the task. It should therefore be obvious that measures of ability must be complemented by measures of motivation in order to satisfactorily reproduce, or predict the scores obtained from, a measure of achievement.

It is here suggested that the problems that have been encountered by those attempting to derive measures of achievement motivation which will yield significant correlation coefficients with measures of scholastic achievement resemble the problems which developers of early measures of ability encountered. These problems and the eventual solution are reviewed by Anastasi who comes to the conclusion:

> The tests of sensory discrimination and other simple processes by Galton, Cattell, and other early investigators proved to be disappointing as predictors of educational achievement and other practical indices of intellectual functioning.... The French psychologist, Alfred Binet, departed from this approach and sought to measure intelligence more directly through the use of relatively complex tasks. (Anastasi, 1965, p. 29)

The tests of sensory discrimination, etc.--which were direct results of behavioral research on animals--are analogous to attempts to measure motivation in terms of a limited number of basic needs, e.g., need for food, air, light, warmth, sex, exercise, avoidance of pain

and sleep. In keeping with this school of thought, a need for achievement was introduced to explain motivation contributing to differences in achievement.

Direct attempts to measure this need for achievement have resulted in scales such as those of McClelland, who uses a projective technique, and Edwards, who uses an inventory. Both techniques yield scores derived from the individual's expressed desire to achieve, although the projective technique allows such an expression to be in a more subtle form. Wahlstrom (1965) reviewed the development of these two techniques and the research connected with their predictive validity. With respect to predicting scholastic achievement, neither of these techniques appear to yield results which are consistently significant, especially when variance in common with measures of ability is removed. Criticisms of these techniques cited by Wahlstrom include the nonspecificity of the measures of need for achievement as predictive measures, the item transparency of the Edwards scale, and the requirement by the McClelland scale for individual administration which raises questions concerning efficiency with respect to testing time and inter-judge reliability.

The scale herein proposed gains credence as a possible solution to the aforementioned problems from the following quotations from Greene:

> Motivation includes all goal-seeking activities, which are usually grouped under needs, interests, and attitudes, or sentiments. ...needs are often related to basic physiological processes, interests to specific personal goals, and attitudes seem to depend mainly upon cultural ideals:

> social, political, religious, vocational, artistic and recreational. (Greene, 1952, p. 31)
>
> Interests of children often seem to be motivated by desires for security, for domination, for escape from arbitrary limitations of home or school, and for unrestricted freedom and adventure. Such interests often have little relation to vocational abilities and opportunities. Adolescents' interests usually undergo changes concomitant with the realization of abilities and limitations and the establishment of more mature ideals. (Greene, 1952, p. 549)

It seems reasonable to suggest that motivation measured by items designed to evaluate interests rather than basic needs will be more closely related to the specific activities undertaken by an individual, i.e., measuring interests related to academic work will provide a measure of motivation which is more closely related to scholastic achievement than is a measure of the more general motivation known as need for achievement.

An objectively-scored self-rating scale can avoid some of the possible criticisms of inefficiency which may be associated with a scale such as that developed by McClelland, but can be faulted if the items are such that responses may be based on social desirability or perceived "correct" answers rather than being based on the individual's perception of himself. To avoid this possibility, items should consist of choices which are judged equal in terms of social desirability and should not be intuitively obvious with respect to their contribution to the total score for a particular scale. This, in part, led to the consideration of the Kuder interest inventories as suitable sources of items for the derivation of the proposed scale.

The best known of Kuder's interest inventories is the Kuder Preference Record - Vocational which consists of 168 items, each of which is a forced-choice triad, from which the individual must select one choice he prefers most and one choice that he prefers least of the three. Ten different scoring keys are available for the inventory yielding scores for vocational interest scales entitled Outdoor, Mechanical, Computational, Scientific, Persuasive, Artistic, Literary, Musical, Social Service, and Clerical. This inventory is "especially appropriate for use with high-school groups." (Thorndike and Hagen, 1961, p. 587) Since the Alberta school system divides its curriculum into routes which are vocationally oriented--pre-employment (menial), vocational (skilled-trade), general (business), and matriculation (university-professional), it seems probable that students have a certain degree of vocational orientation toward their school work, and that there exists a correspondence between vocational interests and academic interests, or between the level of each. If this is true, it should be possible to use items designed to evaluate vocational interests for the evaluation of academic interests. This method of attack has the advantage of reducing any item transparency that may exist.

The investigation of a second interest inventory developed by Kuder, the Kuder Preference Record - Personal, was also carried out--primarily to ensure that a better academic achievement orientation (motivation) scale can be derived from the KPR - Vocational. The KPR - Personal is similar in construction and format to the KPR - Vocational but yields scores for five different scales entitled Group Activity,

Stable Situations, Dealing with Ideas, Avoiding Conflict, and Directing Others. The scales of the KPR - Personal appear to characterize an inventory which would be more conducive to the development of a motivation scale similar to that constructed by Edwards, i.e., a general achievement motivation scale rather than an academic-achievement motivation scale.

A second major reason for attempting to extract an academic-achievement orientation scale from the Kuder Preference Record can be traced to the admonishment to vocational counsellors, which is in turn passed on to the students, that a person's interests must be evaluated in the context of his abilities when making vocational decisions--including decisions with respect to further schooling. Consideration of the inverse of this relationship does not seem to be as popular, i.e., that a person's abilities must be considered in the context of his interests when making such decisions. In the words of Thorndike and Hagen,

> Interest measures and ability measures deal with two quite different aspects of fitness for a field of study or work. Each provides information that supplements the other. Interest is not a substitute for ability, and conversely, ability to learn the skills of a job is no guarantee of success or satisfaction in the job. (Thorndike and Hagen, 1961, pp. 331-332)

It would seem that the proposed measure of interest would be especially valuable in helping a student make decisions whose ability or past achievement is borderline with respect to requirements for furthering his education. A desired outcome of this study, then, was the increased usefulness and attractiveness of the Kuder Preference Record to

the vocational counsellor by providing a method of extracting further information from the inventory and by drawing further attention to the importance of considering the interests of an individual when assisting him in his decision making.

Since students in Alberta are presently faced with a major decision point with respect to further education at the end of grade nine when it is necessary to select a route which they will follow in high school, this study concerned itself with samples of grade nine students. The main sample came from a school which draws pupils from a relatively heterogeneous community with respect to socio-economic environment. The Kuder Preference Records and Lorge-Thorndike Tests of Intelligence were administered to this sample in the fall of their grade nine year while the spring term examinations in their academic courses were used to obtain an estimate of their academic achievement. The proposed scale derived from this sample was also applied to two smaller samples from schools in more socio-economically homogeneous communities.

The main problem to be investigated in studying these samples was to determine whether or not interest items contained in the Kuder Preference Record could be identified in order to form a scale which would yield a satisfactory correlation with academic achievement; for the purposes of this study, the lower bound for a satisfactory correlation was arbitrarily set at .50. It is suggested that such a scale may be used as a measure of the second major component contributing to variation in academic-achievement scores, academic-achievement motivation.

CHAPTER II

THE KUDER PREFERENCE RECORD

It is probably fair to say that reference to the Kuder Preference Record is usually a reference to the Kuder Preference Record - Vocational. Since there is a scarcity of reported research dealing with the Personal form, this chapter will concern itself with the Vocational form and often refer to it simply as the Kuder Preference Record. However, since the format of the Personal form is identical and its development was similar to that of the Vocational form, there will be many statements about the Vocational form which will also apply to the Personal form.

Construction

> Development of the Kuder Preference Record - Vocational began during the school year 1934-35. Form A was published in 1939. This edition included seven interest areas. In 1942, Form B, which gave scores for nine interest areas, was published, and in 1948, Form C, including ten interest categories, was made available. (Kuder, 1956, p. 2)

The main criterion for the development of interest scales by Kuder was that the scales should be relatively independent of each other. The basic postulate underlying this desire for independence of scales was that once a limited number of such scales had been constructed, the task of determining an individual's occupational interests would be reduced to the problem of assigning appropriate weights to his scores on the various scales of the inventory. It seemed reasonable to assume

that the number of different interest scales which could be constructed such that scores obtained on them were independent of each other and which were relevant to vocational choices would not be prohibitively large. That is, the rationale underlying the construction of the scales suggested that interests with respect to a large number of different occupations could be assessed via a relatively short inventory of preferences.

On the basis of this reasoning, Kuder administered a pool of items to a group of students and upon analysis of the responses identified his first vocational interest scale as a literary scale since it consisted of a number of items which showed evidence of consistently measuring one area of interest which appeared to be related to literary activities. He then increased his pool of items and readministered them in an attempt to identify other items which were consistent in what they measured and which had a relatively low correlation with his first scale. Items which seemed to be measuring an independent area of interest but which had non-zero correlations with existing scales were counterbalanced by items having correlations in the opposite direction so that each new scale remained as independent of the other as possible. In this manner the seven scales for the Kuder Preference Record - Vocational Form A were constructed. The last three scales--Mechanical, Clerical, and Outdoor--were developed using the criterion of internal consistency without major concern for their correlations with the previous seven scales. The intercorrelations among the scales based on the administration of Form C to 1000 men are given in Table I. It can

TABLE I

INTERCORRELATIONS OF PREFERENCE RECORD SCALES

SCALES	1	2	3	4	5	6	7	8	9
0. Outdoor	.344	-.181	.262	-.519	.110	-.270	-.234	.028	-.353
1. Mechanical		-.111	.311	-.325	.064	-.408	-.255	-.182	-.215
2. Computational			.106	-.171	-.234	.046	-.123	-.183	.544
3. Scientific				-.331	-.177	-.120	-.288	-.083	-.256
4. Persuasive				-.199	.000	.082	-.037	.082	
5. Artistic					.027	.104	-.275	-.265	
6. Literary						.118	-.184	-.029	
7. Musical							-.187	-.033	
8. Social Service								-.206	
9. Clerical									

adapted from Kuder, 1956, p. 21

be seen that the highest correlation between two scales which were constructed according to the criterion of independence is -.331. This correlation, between the Scientific and Persuasive scales indicates that 11 per cent of the variance associated with each of these scales is held in common between the two. From the practical viewpoint, this amount of overlap is quite small.

Reliability

The reliabilities of the scales based on item analyses of a single administration of the inventory are reported by Kuder (1956) and presented in Table II. Kuder suggests that the formula used in the calculation of these reliabilities tends to underestimate the true reliabilities somewhat. It would thus appear that the internal consistency of the scales is quite satisfactory.

Reliability studies concerned with the stability of scale scores over time are reported by Rosenberg (1953), Herzberg, Bouton, and Steiner (1954), and Hale and Leonard (1956). Rosenberg administered the inventory to 91 boys and 86 girls in grade nine and again when they reached grade twelve. Test-retest correlations ranged from .47 for boys on the Persuasive scale to .75 for boys on the Musical scale. Seven of the scale means for the sample of girls displayed a shift which was significant at the .05 level of probability while only two scale means shifted significantly for the sample of boys. Rosenberg suggested that this difference in the number of significant shifts in means indicated greater progress towards maturity of interests on the part of girls. He thus implies that the interests of high school

TABLE II

RELIABILITIES OF KUDER PREFERENCE RECORD
VOCATIONAL SCALES

SCALE	SAMPLE 1000 MEN	100 BOYS	100 GIRLS
0. Outdoor	.92	.90	.89
1. Mechanical	.92	.93	.86
2. Computational	.85	.86	.85
3. Scientific	.85	.89	.90
4. Persuasive	.91	.86	.84
5. Artistic	.86	.90	.90
6. Literary	.86	.88	.87
7. Musical	.86	.90	.84
8. Social Service	.89	.85	.86
9. Clerical	.86	.86	.90

adapted from Kuder, 1956, p. 21

students are not very stable and therefore that the test-retest reliabilities of the Kuder Preference Record for high school samples will decrease as the amount of time increases between administrations.

Herzberg, Bouton, and Steiner report the results of a study based on 267 men and 250 women to whom the Kuder Preference Record - Vocational was administered when they were in their freshman year of college and again when they were in their sophomore year. Reported correlation coefficients ranged from .49 to .83 for women and from .57 to .80 for men. Their own study dealt with the administration of the scales to 150 males and 122 females in high school and a follow-up administration fifteen to forty-nine months later when these students were found in college or at work. The number of males who were in college was 101 while 49 were at work. The corresponding numbers for females was 48 and 74. Test-retest correlation coefficients averaged across the four groups ranged from .63 for the Social Service scale to .84 for the Outdoor scale. They concluded that significant differences exist in the stability of the scales ranging from the highly stable Artistic and Mechanical scales to the less stable Social Service and Musical scales. They also suggested that the scales were more stable for females than for males. Since this sample was older than that used in the study by Rosenberg, the results support Rosenberg's suggestion that girls mature in the area of interests earlier than boys do.

Hale and Leonard administered the Kuder Preference Record - Vocational to 158 males who were enrolled in a school of pharmacy. Their main concern was to determine the effect of a professional

curriculum on interest patterns of the students. Comparison of the interest profiles of 50 freshmen, 27 sophomores, 44 juniors and 37 seniors led them to the observation that "with exception of minor significant differences between means, the four classes adhered to profile patterns previously reported by Remmers and Gage (627 pharmacy freshmen) and by Kuder (130 drugstore managers and pharmacists)." (1956, p. 74)

While Thorndike and Hagen (1961) recommend the Kuder Preference Record - Vocational for use in the high school, it is apparent from the studies cited above that the instrument's test-retest reliability with several years elapsing between administrations is lowest for this population. It is suggested however, that this low reliability is due to the instability of interests in the population rather than to an inherent weakness in the inventory. Whether this instability of interests among high school students is true of all areas including academic interests or is only limited to vocational interests is a question that does not appear to have been studied empirically.

Validity

Discussion of the validity of the Kuder Preference Record requires a series of considerations similar to those in discussing the reliability of the instrument. Kuder recognized the possibility that a subject might respond to the inventory carelessly or in a manner intended to give a false picture of himself. In order to assist examiners in identifying such subjects, Kuder embedded a validity scale into his inventories which consisted of items which the majority of the sample he

had used to provide norms for his inventories answered in a similar manner. The examiner manuals for the Kuder Preference Records thus provide a range of expected scores on the Validity scale. The examiner is advised to attempt to determine whether or not those subjects obtaining scores outside this range understood the directions, have reading comprehension difficulty, answered carelessly or insincerely, or actually do have preferences which are so atypical that they do not prefer activities chosen by the majority of people.

The predictive validity of the Kuder Preference Record as an instrument which provides an indication of an individual's suitability for a given career is given extensive coverage in Kuder's Examiner Manual for the Kuder Preference Record (1956). From this information it can be concluded that the profiles of scale scores of adults in different occupations can be used to differentiate among the individuals with respect to their vocations. Generally, the scales which bear titles that can be related to activities in a given occupation provide useful information about an individual's suitability for a given occupation. Kuder concludes that "the findings reported in the literature tend to bear out predictions made by personnel workers familiar with the occupations involved." (1956, p. 19) The study reported earlier by Hale and Leonard is an example of aspirants to a profession having interest profiles similar to those in the profession thus supporting the suggestion that the inventory does have predictive validity. However, the study reported by Rosenberg again introduces the note of caution that since the vocational interests of young high

school students may not have matured at the time, the predictive validity for this group may be rather low.

The relationship between scores on preference scales and grades in school subjects is also well documented by Kuder whose review of the literature would suggest that there is usually a small, positive correlation between scores on Kuder Preference Record scales and grades in courses having similar titles. For example, Romney (1950) found correlations of .27 and .29 between the Literary scale and achievement in a freshman English class for 566 males and 519 females, respectively. Similarly, Triggs (1943) reported correlations of .32 for men and .42 for women between the Scientific scale and general scientific achievement, .40 for men and .33 for women between the Literary scale and achievement in English literature, and .34 for men and .36 for women between the Computational scale and mathematics scores. Kuder reports the results of implementing preference scales in batteries of tests used for the prediction of success in college and notes that such predictions are more accurate than those based on batteries omitting the scales. He suggests that "this sort of increase is possible because the preference scales usually overlap very little with measures of ability." (1956, p. 20) Literature reporting the relationship between scales and achievement for high school students is noticeably absent.

A Previous Academic Interest Scale

Apparently, the only study which has attempted to construct a new interest scale from the Kuder Preference Record items based on the criterion of obtaining a maximum correlation with achievement was one

undertaken by Detchen (1946). She divided a class of 247 students at the University of Chicago into three groups according to their grades obtained on a social science comprehensive examination and identified items from one of the earlier forms of the Kuder Preference Record which significantly differentiated among the groups using the .05 level of significance. Scores from the scale derived in this manner yielded a correlation coefficient of .60 when compared with the scores on the comprehensive examination. Upon cross-validation with a sample of 106 students, a coefficient of .55 was obtained. For the original group, a coefficient of .51 was still obtained when variance in common with a psychological examination and a placement test was partialled out of the comprehensive examination scores thus indicating that the measure of interest would add a substantial degree of accuracy to the prediction of scores on the comprehensive examination if it were added to the battery of predictor tests.

While the study carried out by Detchen offers a note of encouragement for the present study, implications cannot be deduced by direct transfer since the effects of using a younger sample which has not passed through as many selection programs, and which is therefore relatively less homogeneous, are not immediately apparent. While it is generally expected that a more heterogeneous sample will yield a higher correlation coefficient between scores on two variables, Lavin's (1965) discussion of the correlates of academic achievement points out that heterogeneity-in-general does not necessarily provide the highest correlation coefficients. In some cases, the highest correlation may be

expected between two variables when the sample is quite homogeneous with respect to one or more other variables. The "other" variables included in this study were those suggested by Lavin and discussed in the following chapter.

CHAPTER III

CRITERIA FOR DERIVATION AND ASSESSMENT

Academic Achievement

The most common measure of achievement in public school is the teacher-made test. In Alberta schools, a more standardized set of examinations is administered in cooperation with the Provincial Department of Education at the end of grades nine and twelve. Although this study was based on samples of grade nine students, it was considered undesirable to prolong the study in order to make use of the results from the Departmental Examinations. Instead, the academic achievement criterion scores were obtained from the spring term examinations. It was contended that since these examinations cover the majority, if not all, of the year's work in each of the academic subjects, and since a concerted effort is made by the teachers to construct examinations which will give a reasonably good indication of how each student will perform on the Departmental Examinations, using these spring term examinations as the main criterion for this study would yield approximately the same results as using the more standardized examinations.

The above argument was supported in an intuitive sense by the investigator's observation of the procedures used in constructing these examinations. These procedures included the implementation of suggested items supplied by the Department of Education, the construction of tests by committees of teachers representing a number of schools,

and the use of test items drawn from a pool that had been developed over a number of years. A special effort was made in most cases to construct a test which would approximate the Departmental Examination in style and format. Thus the majority of tests were objective, multiple-choice examinations. The major problem from the investigator's point of view with respect to obtaining academic achievement scores for the samples was the inability to obtain scores based on common examinations across the samples.

Along with the academic achievement scores which were used as the criterion for deriving the proposed scale, a number of other variables were employed in the study as additional criteria for evaluating the scale. The necessity of including these variables is discussed by Lavin who provides the following note:

> ...three factors emerge as basic correlates of academic performance. These are ability, sex and socioeconomic status.... Failure to control for these factors in studies of academic performance may lead to a number of difficulties. (Lavin, 1965, p. 43)

Ability

That a correlation exists between achievement and ability has already been accepted as a fact; a review of research supporting this contention is not considered necessary. However, just as a distinction has been drawn between achievement-in-general and academic achievement, a distinction must be drawn among several different types of ability. This distinction is summarized by MacArthur:

> First intellectual abilities may be conceived "as if" usually correlated in a hierarchical model. At the top of the hierarchy is general intellectual ability, similar

> to Spearman's G but psychologically a kind of allround average of our thinking abilities, and like other abilities at any time in a person's life the resultant of interaction between innate predispositions and experiences up to that time. Further down in the hierarchy are group factors (verbal, numerical, spatial, etc.).... This hierarchy may be further subdivided into an almost unlimited number of increasingly specific abilities. (MacArthur, 1968, pp. 43-44)

The size of the correlation between academic achievement and ability depends on the type of ability being considered. A measure of ability which includes the specific abilities required by an achievement test can be expected to correlate very highly with scores obtained on the achievement test, while a measure which includes specific abilities not required by the achievement test would not necessarily be expected to have much of a correlation with the test. Returning to MacArthur's summarization of the types of abilities, it is noted that "the more nearly specific abilities, low in the hierarchy, are much dependent upon particular experiences which the child may or may not have had. General intellectual ability, at the top of the hierarchy, ...will be less influenced by particular learning from a particular environment." (MacArthur, 1968, p. 45)

Kuder's statement that ability and interests are not usually correlated should probably be rephrased to indicate that interests are not usually correlated with general intellectual ability. It is probably true that the various experiences within a particular environment which influence the development of specific abilities also influence the development of specific interests and that a relatively high correlation can be expected between certain specific abilities and intuitively

corresponding specific interests. With respect to the present study, the measure of achievement orientation used to assess motivation for academic achievement should be constructed so that it is relatively independent of general intellectual ability rather than the more specific abilities required for academic achievement since the sources influencing the development of academic motivation can also be expected to influence the development of academic ability. Some correlation can be expected between academic motivation and the more specialized academic ability. A scale constructed so that it did not yield this correlation would probably not be properly measuring academic motivation.

West (1962) investigated a number of measuring instruments which are frequently used to estimate general intellectual ability. Results of this investigation with respect to grade seven and eight students as summarized by West in his Table XXIX, (West, 1962, p. 111), suggest that the Lorge-Thorndike Intelligence Tests - Nonverbal is a suitable measure of general intellectual ability which is not unduly influenced by past experiences. The Technical Manual of the Lorge-Thorndike Intelligence Tests describes this test as

> ...entirely pictorial, diagrammatic, or numerical. The subtests are Figure Analogies, Figure Classification and Number Series. For the average child, these tests will not predict school performance quite so well as scores based upon the Verbal Battery. However, they permit an appraisal of abstract intelligence which is not influenced by specific disability in reading. (Lorge & Thorndike, 1962, p. 3)

Estimates of the reliability of this instrument as provided by the Technical Manual include an alternate forms reliability coefficient of .776 for 596 grade eight students, a corrected odd-even reliability

coefficient of .928 for 199 grade eight students, and a coefficient based on the comparison of a weighted standard error of measurement across scores to the standard deviation of the test of .80 using 1419 students. For the purpose of constructing the proposed scale, then, the Lorge-Thorndike Intelligence Tests - Nonverbal Level 4 was used as a measure of general intellectual ability.

The Lorge-Thorndike Intelligence Tests - Verbal is a counterpart to the Nonverbal Battery which includes the subtitles Word Knowledge, Sentence Completion, Verbal Classification, Verbal Analogies, and Arithmetic Reasoning. These titles suggest an instrument which is measuring some of the more specific group factors of ability, i.e., verbal and numerical, which are directly applicable to the tasks presented to the student by his school work. "Experience over the years with tasks of these five types has indicated that such tasks provide a good and useful measure of ability to deal with abstractions presented in verbal form and that, since this type of ability is related to academic achievement, they provide a good index of scholastic aptitude." (Lorge & Thorndike, 1962, p. 2) The three estimates of reliability for the Verbal Battery, with number of cases corresponding to those for the Nonverbal Battery, are .865 for the alternate forms, .929 for the corrected odd-even, and .92 for the weighted standard error of measurement vs. standard deviation of test. (Lorge & Thorndike, 1962) This battery was thus chosen as the measure for assessing the correlation between academic ability and academic motivation. It should be noted that the Technical Manual cited above reports a correlation of .70 between the

Verbal and Nonverbal Batteries for 382 grade nine students. This indicates that the two batteries have approximately fifty percent of their variance in common and that there is a possibility, although quite remote, of a variable having close to a correlation of .70 with one of the batteries and a correlation of .00 with the other. (Taking the reported alternate forms reliability into consideration would reduce this possible correlation to about .50.)

Sex

The second basic correlate of achievement suggested by Lavin is sex. While the reasons for obtaining a correlation between ability and achievement are generally clear, it is not nearly so clear why there should be sex differences in academic achievement. Lavin has reviewed a number of studies investigating sex differences from which he concluded that "the studies that assess the relation between sex and academic performance show that females have higher academic performance than males." (Lavin, 1965, p. 128) For example, Jackson (1955) compared the grades of 1657 men and 1296 women who had completed one year of college and found that women obtained significantly higher grades than men. Lavin (1965, p. 129) reports a study by Hughes who found that girls were superior to boys in reading achievement through the fourth grade but that this difference was neither consistent nor significant after the fourth grade. However, this study does not entirely contradict Lavin's earlier conclusion since he noted that there were very few studies dealing with students in elementary and high school and therefore based his conclusion only on college studies.

The importance of sex differences in achievement with respect to this study arises from results reported by Abelson (1952) who found significant sex differences in accuracy of predicting college grades from high school grades, and by Jackson (1955) who found sex differences in accuracy of predicting college grades from measures of ability. In both cases the more accurate predictions were made for the women. These findings support the suggestion that the contributing influences on differences in achievement among individuals are different for the two sexes. An example of such an influence appears in the following research summary.

> Of the four studies in which ability is adequately controlled two show the presence of a sex difference. Choice of a major field is directly related to academic performance in the case of males, but no such relationship pertains for females. Perhaps the psychological significance of commitment to a major course of study is different for males than for females. (Lavin, 1965, p. 72)

Wahlstrom, in his attempt to reconcile the contradictory results of two need-achievement measuring instruments, suggested that the two scales are measuring different kinds of need achievement and that boys tend to display one kind while girls display the other thus yielding a low correlation between the two scales. His hypothesis was that "academic achievement motivation of females and males...differ in that females are more oriented toward reaction from others, i.e., social situations, while the behavior of males may be more autonomously determined by their own internal standards of achievement." (Wahlstrom, 1965, p. 4)

A further suggestion for the appearance of sex differences in

achievement, at least at the elementary and secondary school levels, is the particular organization of the school. Lavin (1965, pp. 130-131) supports the contention that schools are female oriented in the sense that female teachers out-number males and the rules implemented for the maintenance of discipline require a female-like role of submissiveness. Thus, males find it harder to adjust to the expectations of teachers than females do.

While the present study attempted to establish only one achievement orientation scale which can be applied to both males and females, it was apparent that the scale must be evaluated separately for the sexes. It was suggested that such a scale would account for some of the differences in achievement between the sexes.

Socio-economic Status

The third basic correlate of achievement which must be controlled when studying individual differences in achievement is socio-economic status. This status is taken as an index of the richness of the individual's environment with respect to providing experiences conducive to the development of maximal intelligence, (Bloom, 1965; Elley, 1961; Hunt, 1961), and of the social mores of the individual's family and peers which are expected to influence his attitudes toward teachers, academic achievement and the operation of the school in general. (Bloom, 1964; Bloom, 1965; Elley, 1961) The multiplicity of environmental variables which affect intellectual ability and motivation, and thus academic achievement, has thus far prevented the development of an all-encompassing inventory which will provide an index or indices which

adequately describe the environmental influences. Research related to this problem is presently concerned with the number of dimensions required for an adequate assessment. (Bloom, 1964) However, Elley (1961) found that the Blishen Occupational Rating Scale, (Blishen, 1961), proved to be a useful instrument for the assessment of socio-economic status in the sense that hypothesized differences in socio-economic bias of various measures of ability were statistically confirmed. His hypothesis was that tests of ability which are heavily weighted by the verbal ability factor yield a higher correlation with socio-economic status than do tests of ability which are primarily measuring general intellectual ability. A summary of initial findings, (Elley, 1961, p. 128), offers support for both the contention that academic ability is more dependent on environment and past experience than is general intellectual ability, and the suggestion that the Blishen Occupational Rating Scale provides some indication of an individual's environment and past experience.

Blishen's scale ranks the occupations of Canadians according to two criteria--amount of education required by the occupation and average salary derived from the occupation. Since this scale has been shown to correlate with academic ability and academic achievement, (Elley, 1961, p. 160), and since it is a relatively simple method of arriving at an index for socio-economic environment, it was employed in this study in order to provide a control for socio-economic status while studying other correlates of achievement. However, this does not suggest that the scale provides an accurate measure of all the

environmental variables affecting the development of academic ability or motivation. Just as research is presently being undertaken to determine the relationships between environmental variables and the development of ability, it is hoped that, once an adequate measure of academic-achievement motivation has been developed, more detailed studies will be carried out to determine the effects of environment on this type of motivation. For the present study, it was suggested that differences in achievement would be found which were related to socio-economic status as measured by the Blishen Occupational Rating Scale, and that some of these differences would be related to the proposed academic-achievement orientation scale.

CHAPTER IV

DESIGN OF THE STUDY

The proposal for investigation in this study as set out by the previous chapters was that an academic-achievement orientation scale could be constructed from vocational interest items which would provide a measure of motivation that was independent of general intellectual ability yet correlated with academic achievement. It was further suggested that this scale would account for some of the differences in academic achievement found between the sexes and among the levels of socio-economic status, and that it would be correlated with a measure of the more specialized academic ability.

The theoretical design of the study is presented in the following definitions, postulates and hypotheses.

Definitions

1. motivation - "includes all goal-seeking activities." (Greene, 1952, p. 31)
2. interest - "a generalized behavior tendency of an individual to be attracted to a certain class of incentives or activities. This conception of an interest is sufficiently broad to include negative as well as positive attractions." (Rethlingshafer, 1963, p. 259)
3. academic-achievement orientation - motivation directed toward academic achievement. "Motives have both force and direction. Present measures of need achievement consider only the former while

neglecting the latter." (Shaw, 1961, p. 285) The title of the proposed scale and the discussion thus far indicate that this study was primarily concerned with measuring motivation in a given direction, i.e., academic motivation.

4. ability - an individual's potential or capacity to perform a given set of activities. Unless the context indicates otherwise, ability, in this thesis, refers to general intellectual ability.
5. general intellectual ability - "a kind of allround average of our thinking abilities." (MacArthur, 1968, p. 43)
6. academic ability - the ability to perform the tasks presented to the student in his academic work. The major distinction between general intellectual ability and academic ability, for the purpose of this thesis, is the inclusion of the ability to communicate verbally in the latter.
7. academic achievement - operationally defined as the average score obtained by an individual on tests designed to assess his accomplishments in the five academic courses in grade nine--Literature, Language, Social Studies, Mathematics and Science.

Postulates

1. The two major, general components of academic achievement are ability, the capacity to achieve; and motivation, the desire to achieve.
2. Academic ability and academic motivation are heavily influenced by past experiences. This common background of development produces a correlation between the two.

3. An individual's responses to preference items provide an inventory of his interests and an indication of the directions of his motivation.

4. There exists a relation between academic interests and vocational interests that permit the use of preference items which successfully measure vocational interests to measure academic interests.

5. Scores obtained on the proposed academic-achievement orientation scale provide an estimate of the degree to which an individual's motivation is directed towards academic work. (The possibility that different individuals possess different amounts of total motivation is not taken into consideration.)

Hypotheses

I. (a) Items of the Kuder Preference Record can be identified which can be combined to form a scale which has a relatively high correlation with academic achievement but, at the same time, a relatively low correlation with general intellectual ability.

(b) Items from the Kuder Preference Record - Vocational provide a better scale, in the sense of satisfying I (a), than do items from the Kuder Preference Record - Personal.

II. The scale yields correlations with academic ability, and achievement in specific academic subjects, which are less than the correlation between the scale and the measure of general academic achievement, but greater than the correlation between the scale and the measure of general ability.

III. The scale accounts for some of the differences in academic

achievement found when comparing boys and girls.

IV. The scale accounts for some of the differences in academic achievement found when comparing different levels of socio-economic status.

V. The scale yields higher correlations with academic achievement than do any of the scales presently existing for the Kuder Preference Record - Vocational or the Kuder Preference Record - Personal.

Statistical Design

The statistical design used to test the above hypotheses is outlined in the following paragraphs.

Hypothesis I - In order to identify the items which were to be included in the proposed scale, the items were first scored in a manner which yielded a maximum correlation with achievement. For the sake of conformity and a desire to derive a scale which could be easily scored, the same scoring technique was employed as that used by Kuder. (Kuder, 1956, pp. 28-29) In effect this method pays attention to only one of the three choices in a given item for a given scale. If an individual responds positively, in the keyed direction, to this choice, he receives two points. If he responds negatively, he receives no points and if he ignores the choice--responds only to the other two choices--he receives one point. Thus the first step in developing a key for the proposed scale was to obtain scores for each item when each choice was treated as though it were the one that should be keyed. This means that each item was scored three times assuming that a "prefer most" response to a particular choice would be the keyed response in the new scoring key. Secondly, one set of scores from the three sets for each

item was selected for attention on the basis that this set showed the highest correlation with achievement. If this correlation was negative, the "prefer least" response was keyed for the choice being attended to in that item so that the correlation would become positive. An initial reduction in the number of items to be considered for the new scale was carried out by selecting only those items which displayed a correlation significantly different than zero using a one-tailed test and the .05 level of probability. Factor analysis was used to complete the item selection process.

Since a scale was desired which had a relatively high correlation with achievement but a low correlation with general intellectual ability, an orthogonal factor solution was suggested. The desired outcome of this solution was the identification of two factors which could be called an achievement-ability factor and an achievement-motivation factor, respectively. However, to expect such an outcome from a correlation matrix in which the majority of the variables are interest items is probably expecting too much. While a rotation of the factor solution for the correlation matrix could probably have been carried out which would have yielded the desired two factors, the investigator proposed a factoring technique which is probably more simple and direct. This technique involves a combination of the diagonal factoring method, (Fruchter, 1954), and the principal axes method of factoring. (Harmon, 1967)

The first factor was extracted from the correlation matrix, which represented the relationships among the Nonverbal Battery, average

achievement, and the items displaying a significant correlation with achievement, by using the diagonal method. Fruchter (1954, p. 52) indicates that this method requires very accurate estimates of the communalities. However, since very little common variance was expected between the measure of general intellectual ability and each of the interest items, the communality in this case would not have been serving the purposes of the design and a factor based on this communality would have been practically meaningless. Therefore, the self-correlation of 1.0 was used rather than some other estimate of the communality. The first factor then, extracted by the diagonal method, was an achievement-ability factor which gave a factor loading of 1.0 to the measure of general intellectual ability and appropriate loadings to the other variables based on this particular factoring technique. The residual matrix remaining, when all variance in common with the Nonverbal Battery scores had been removed, was then submitted to the principal axes method of factoring. It was suggested that a factor could be identified from this solution which could be labelled an achievement-motivation factor. The possibility of the need to rotate the factors in order to facilitate this identification was anticipated.

Since a scale was desired which required the administration of only one of the Kuder Preference Records, the above technique was applied separately to two correlation matrices--one which included information about interest items from the Kuder Preference Record - Vocational, and the other information about interest items from the Personal form. Thus two achievement-motivation factors were obtained

from which two different scales could be determined. Since no statistical criterion was available for deciding which factor loadings were high enough to warrant the inclusion of an item in the proposed scale, the commonly accepted cutting point of .30 was suggested providing this yielded a scale which was of a reasonable length when compared to Kuder's own scales. The comparison of the two scales thus derived, one from the Vocational form and one from the Personal form, was made by inspecting their respective correlations with average achievement scores and with nonverbal ability scores. The significance of the difference between the two correlation coefficients was determined using the .05 level of probability.

Hypothesis II - The second hypothesis was tested by comparing the correlations between the better of the two derived scales and average achievement and between the scale and nonverbal ability, with the correlations between the scale and verbal ability and between the scale and scores in each of the academic subjects. The significance of the differences between the correlation coefficients were again determined using the .05 level of probability.

Hypothesis III - This hypothesis assumed that a significant difference in average achievement would be found when comparing boys and girls. A one-way analysis of variance design was used to verify this assumption by grouping according to sex and using average achievement scores as the criterion. It was intended that, if a significant difference between the sexes was found, using the .05 level, a one-way analysis of covariance design would be used where scores from the new

scale would be introduced to the original design as a covariate. The hypothesis suggested that the significant difference found using analysis of variance would disappear when analysis of covariance was used.

Hypothesis IV - The same technique was used for testing this hypothesis as was used for testing Hypothesis III except that the grouping was done according to socio-economic status.

Hypothesis V - The correlation between average achievement and the new scale was compared to the correlations between average achievement and each of Kuder's scales. The significance of the differences was determined using the .05 level of probability. Since Kuder provided scale scores which were based on different norms for the two sexes, separate correlation coefficients had to be calculated for each of the sexes.

Since the correlations to be compared using a test to determine the significance of the difference were always based on the same sample, the statistical test had to take into account the dependencies between the correlations. The test used and its limitations with respect to generalizability are discussed in Walker and Lev. (1958, p. 263)

CHAPTER V

PROCEDURE AND PRELIMINARY RESULTS

Three samples were used in testing the hypotheses--a "basic" sample and, whenever possible, two secondary samples. The first sample consisted of 135 students, 69 girls and 66 boys, which made up the total enrollment of grade nine students who were registered for the entire school year, 1967-68, at a junior high school in one of the suburban districts of Edmonton. It was intended that this sample be reasonably heterogeneous with respect to ability, achievement, sex and socio-economic status. It is apparent that the sample is very close to being equally representative of the two sexes. Assessment of the heterogeneity of the sample with respect to the other variables will be delayed until later in the chapter.

The secondary samples were two smaller samples which consisted of 63 and 51 students, respectively. The 63 students, 30 girls and 33 boys, were enrolled in grade nine at a junior high school which was judged to be in a higher socio-economic district of Edmonton, while the 51 students, 30 girls and 21 boys, were enrolled in grade nine at a junior high school which was considered to be in a lower socio-economic district of Edmonton. Two classes within each of the schools were selected to make up the two samples such that the students in the higher socio-economic sample were also considered to be students having high ability while those in the lower socio-economic sample were judged

to have relatively low ability. It was not possible to administer ability tests to these two smaller samples, nor was there adequate information available from previous administrations to statistically confirm these ability classifications. Comparisons between these two samples were not attempted since it was not possible to obtain achievement scores based on the same tests for each of the samples. The design of the study called for the application of the proposed scale, developed on the basis of the main sample, to the two smaller samples. Taking this into consideration, along with the amount of information available for the two samples and the nature of the samples, indicated that only hypotheses III and V should be investigated using these smaller samples. The inclusion of these samples in the study was justified on the grounds that hypothesis V was the major hypothesis of the study.

Data Collection

The Kuder Preference Records - Vocational and Personal and the Lorge-Thorndike Intelligence Tests - Nonverbal and Verbal Level 4 were administered to the main sample, and the Kuder Preference Records were administered to the two secondary samples by the investigator early in the fall term of the students' grade nine year. Information required for classification according to socio-economic status, i.e., father's occupation, was also obtained at this time by referring to the cumulative record card kept for each pupil by the schools. The achievement tests were administered by the schools close to the end of the school year within their regular testing programs. It is suggested that this

to have excessively low setting. If you use your ability to manipulate ability tools to close the emotional envelope, and use their emotional information processing flow (previous communications to reconstruct creative ideal ability classifications). Communicating overseas loses the mental data and economical sense to use the capacity to obtain instant access based on the same tools for each of the sessions. The design of the study method for the application of the processes were developed on the basis of the data samples to the two audio recording tape interviews, since with the amount of information available for the two sampling and the results of the sessions, functional user only perspectives [7] and I should be investigated using common sampling sequences. The inclusion of these examples in the study was limited on the grounds that opportunity I was the major hypothesis of the study.

Data collection

The Super Interviews Sample - Microcomp and Internet and the Cross-Functional Investigation Tools - Homebuyer and Owner Users were administered to the main sample, and the Super-Interviews Sample was administered to the two secondary samples of the investigations using in any case case of the scenarios' grade nine years. The information resulting for classification technology on mathematical science, I.S. , tables of comparison, was also obtained at this time by reference to the secondary real data for each point of the sample. The questionnaire cards were administered by the schools alone in the end of the school year within their regular daytime sessions. It is suggested that this

procedure for data collection allowed for better assessment of the predictive validity of the instruments used since approximately six months elapsed between the administration of the predictor instruments and that of the criterion instrument. This procedure was considered especially appropriate with respect to the Kuder Preference Records since it is possible that, at the end of the school year when the students are more informed about their success in grade nine, the students will adjust their interests to conform to their demonstrated abilities. The possibility of a relatively large adjustment taking place depends on the degree to which the grade nine curriculum stresses academic studies more than the previous grades do. It is suggested that this difference may exist in the schools of Alberta where students are faced with the threat of province-wide examinations in the academic subjects at the end of grade nine and the need to qualify for certain programs which begin in grade ten. Whether or not such an adjustment does take place and what effects this adjustment has on the proposed scale were not investigated in this study.

Among the precautions taken in collecting the data, the following should be noted.

Kuder Preference Records - Directions given to the students on how to respond to the inventory were those specified in the Examiner Manual, i.e., most importantly, the inventories were not tests and there were no correct answers for them except the answers that best described each individual student. The inventories were administered during regular class periods and everyone was given time to answer

procedure for data collection allowed for better assessment of the predictive validity of the instruments used since approximately six months elapsed between the administration of the predictor instruments and that of the criterion instrument. This procedure was considered especially appropriate with respect to the Kuder Preference Records since it is possible that, at the end of the school year when the students are more informed about their success in grade nine, the students will adjust their interests to conform to their demonstrated abilities. The possibility of a relatively large adjustment taking place depends on the degree to which the grade nine curriculum stresses academic studies more than the previous grades do. It is suggested that this difference may exist in the schools of Alberta where students are faced with the threat of province-wide examinations in the academic subjects at the end of grade nine and the need to qualify for certain programs which begin in grade ten. Whether or not such an adjustment does take place and what effects this adjustment has on the proposed scale were not investigated in this study.

Among the precautions taken in collecting the data, the following should be noted.

Kuder Preference Records - Directions given to the students on how to respond to the inventory were those specified in the Examiner Manual, i.e., most importantly, the inventories were not tests and there were no correct answers for them except the answers that best described each individual student. The inventories were administered during regular class periods and everyone was given time to answer

them completely even when this meant allowing them to work at the inventories on several days. Following the periods of administration, each inventory was checked, item by item, to ensure that the proper procedure was used in responding to them and that no items were omitted. Thus, when the administration of the inventories was completed, each student had responded to each item using the prescribed procedure. Those students having a low score on the Validity scale of either of the inventories, as set out by the Examiner Manual, were asked to re-do that inventory. Some students were absent from school for a number of days which made it infeasible for them to complete one or both of the inventories. The only students eliminated from the samples for any reason whatsoever were those who did not complete either of the Kuder Preference Records. There were two of these in the three samples. Thus, some students for whom some data is missing were retained in the samples.

Lorge-Thorndike Intelligence Tests - These tests were administered according to the directions given in the Examiner Manual. One of the more important considerations for the administration of these tests was the time limits specified for working on a given subtest. These time limits prevented some of the students from answering all of the items. However, the purpose of these tests was to obtain total scores rather than responses to each item. The school where these tests were administered was visited several times in an attempt to administer the tests to as many students in the main sample as possible. As a result, ability scores were obtained for all but one individual from each of

the two batteries administered.

Socio-economic status - The father's occupation as given on the pupil's cumulative record card was verified by referring to Henderson's Greater Edmonton Directory (1963) for those cases in which the information given on the record card was considered too vague to allow proper classification. For those cases in which the father was deceased, the mother's occupation was used for classification purposes.

Academic achievement tests - Since these tests were administered within the schools' regular testing programs, the investigator had no control over the method used in administering them--although some assistance was given by providing possible items to be used by the school in testing the main sample. In all cases, the scores obtained from these tests were the raw scores rather than scores which had been scaled by the schools for their own purposes.

Using the Test Scores

Since the scoring of the Kuder Preference Records yields both raw scores and percentiles while that of the Lorge-Thorndike Intelligence Tests yields raw scores, intelligence quotients, age percentiles and grade percentiles, a decision regarding what type of scores to use in the statistical analysis had to be made. The fact that much of the statistical analysis assumed that the sample scores came from a population of scores having a normal distribution led to the decision to use scores, when a choice existed, which were based on a normal distribution. Thus the percentile scores obtained from the Kuder Preference Records for each of the scales were converted to *z* scores by

calculating the unit normal deviate corresponding to the given area under the curve. (Ferguson, 1966, pp. 99-101) The percentile scores themselves were those provided by Kuder and based on his norming groups. Kuder derived separate percentile norms for each of the sexes as well as for youth and adults. The derived z scores were thus based on normal populations represented by 3,418 boys and 4,466 girls. (Kuder, 1956) Similarly, the scores used from the Lorge-Thorndike Intelligence Tests were z scores that had been derived from grade percentiles which Lorge and Thorndike present in their Examiner Manual for these tests. Grade percentiles were chosen as the appropriate norms to use in this study since the samples were intended to be representative of grade nine students. The z scores for each of these inventories and tests were further transformed, arbitrarily, so that they would correspond to a distribution which had a mean of 50 and a standard deviation of 10 in the normal populations. No transformations were performed on the scores obtained from Blishen's Occupational Rating Scale since these were already based on a population having a mean of 50 and a standard deviation of 10. (Blishen, 1961) The scores on each of the academic achievement tests were also arbitrarily transformed to the above mean and standard deviation for each school before averaging across the scores to obtain the general academic achievement scores. No attempt was made to alter the shapes of the distributions of the achievement scores since there was no information available to connect them to a population, and the two smaller samples were not expected to yield normal distributions.

Preliminary Results

The means and standard deviations for each of the samples on the variables which have scores that can be related to norming groups are reported in Table III. With respect to the Kuder Preference Record scales, no hypotheses were stated concerning the relationship of the samples to the norming groups or to each other. Therefore no statistical tests were performed to aid in the comparison of the samples and, for the purposes of this thesis, it is sufficient to note that the sample means for the different scales approximate the population means of 50 while the standard deviations indicate that each of the samples tend to be slightly more homogeneous than the population. While a specific description of Kuder's norming groups was not available, it is probably true that they represent a much wider age and grade range than the present samples which would account for their greater degree of heterogeneity.

Sample I, the only one to whom the Lorge-Thorndike Intelligence Tests were administered, appears to be slightly above average and more homogeneous with respect to ability when compared to the norming groups. However, it is generally conceded that the American norms for these tests are not entirely appropriate for Canadian students. This contention is supported by the very recent introduction of Lorge-Thorndike Intelligence Tests with Canadian norms to the test-user market. Thus the statistics provided in Table III do not necessarily suggest that Sample I is other than average and heterogeneous with respect to ability.

TABLE III

SAMPLE SCORES ON NORMED VARIABLES

VARIABLE	SAMPLE I N	SAMPLE I MEAN	SAMPLE I S.D.	SAMPLE II N	SAMPLE II MEAN	SAMPLE II S.D.	SAMPLE III N	SAMPLE III MEAN	SAMPLE III S.D.
Kuder Preference Record									
0. Outdoor	133	48.35	9.44	62	49.46	9.24	50	48.72	8.98
1. Mechanical	133	49.77	8.27	62	47.32	8.00	50	46.83	6.86
2. Computational	133	52.44	8.63	62	52.61	11.17	50	53.02	8.27
3. Scientific	133	53.80	8.14	62	55.95	7.41	50	54.96	7.77
4. Persuasive	133	48.77	9.38	62	49.06	9.81	50	50.12	8.50
5. Artistic	133	53.85	8.66	62	52.21	10.51	50	50.93	7.63
6. Literary	133	49.38	7.98	62	50.97	10.35	50	49.49	7.57
7. Musical	133	42.73	8.35	62	47.17	9.85	50	42.58	7.99
8. Social Service	133	49.16	10.48	62	47.18	9.92	50	50.40	9.22
9. Clerical	133	50.40	8.90	62	48.81	9.94	50	51.98	9.30
A. Group Activity	134	47.96	9.05	61	47.40	7.89	44	48.77	9.10
B. Stable Situations	134	43.16	8.77	61	44.90	9.45	44	46.41	9.40
C. Dealing with Ideas	134	51.04	8.50	61	49.21	8.63	44	53.34	7.73
D. Avoiding Conflict	134	47.16	8.10	61	50.29	8.72	44	46.78	8.83
E. Directing Others	134	48.37	9.35	61	49.58	9.10	44	46.43	7.49
Lorge-Thorndike Intelligence									
Nonverbal Battery	134	60.05	7.71						
Verbal Battery	134	61.22	6.56						
Blishen Occupational Rating	135	53.48	7.56	63	62.99*	9.71	51	45.10*	3.74

*significantly different from Sample I at .05 level using a one-tailed test

It was suggested earlier that Sample I would be relatively heterogeneous with respect to socio-economic status while Sample II would be from a higher socio-economic district and Sample III would be from a lower socio-economic district. That such was actually obtained is supported by the statistics reported in Table III for the Blishen Occupational Rating Scale. With respect to the sample means, Sample I has a mean which is slightly higher than Blishen's population mean of 50. Comparing the other two samples to Sample I by using a t-test, it was found that Sample II had a mean significantly above Sample I while Sample III had a mean significantly below Sample I when using a one-tailed test and the .05 level of probability.

Inspection of the standard deviations of each of the samples raises some questions about the obtained heterogeneity or homogeneity as compared to the earlier description of the samples. Comparison of the variance of Sample I to that of Blishen's population variance using an F-test indicated a significant difference at the .05 level. Furthermore, a comparison of the ranges, 39.3 to 77.4 for Sample I vs. 32.0 to 90.0 for Blishen's population, indicated that Blishen's classes 1 and 7 are under-represented and that it may be more appropriate to label Sample I as average, rather than heterogeneous and representative of the total population with respect to socio-economic status.

Sample II had the largest standard deviation of the three on the Occupational Rating Scale. However, this apparently high degree of heterogeneity becomes relatively homogeneous when the distribution of Blishen's population and his division of the scale into classes is

taken into account. Blishen's population is a highly skewed one as indicated by the fact that the z scores range from -1.8 to +4.0 while those in a normal distribution usually range from approximately -3.0 to +3.0. When the distribution is broken down into classes on the basis of prestige, the class intervals are far from equal--the interval size of Class 1 is more than ten times as large as that of Class 4. Furthermore, Blishen (1961, p. 479) points out that almost one-third of the Canadian working population in 1951 belonged to Class 5 which has one of the smaller interval widths. With respect to socio-economic class representation, one-fifth of Sample II comes from Class 1, three-fifths from Class 2, and one-fifth from Classes 3, 4 and 5. It is suggested, then, that the large standard deviation for Sample II is more a function of the fact that it came from the upper half of the distribution than an indication of its heterogeneity. Thus, Sample II retained the higher socio-economic label.

The standard deviation of occupational scores for Sample III was satisfactorily low to permit calling the sample homogeneous. Following the discussion above, it is worth noting that this sample can be broken down into approximately 6% for Classes 2, 3 and 4, 41% for Class 5, 35% for Class 6, and 18% for Class 7. This fact, along with the earlier note regarding the sample mean, indicated that this sample could be properly labelled lower socio-economic.

A final observation that should be pointed out in discussing the preliminary results for this study concerns the obtained correlation coefficients among the two measures of ability and the measure of

academic achievement. For Sample I the correlation calculated between the Verbal Battery and the Nonverbal Battery of the Lorge-Thorndike Intelligence Tests came to .561 while that for the Nonverbal Battery and average achievement was .540 and that for the Verbal Battery and average achievement was .791. Expressed in terms of calculated common variance, the two measures of ability have 31.5%, nonverbal ability and achievement have 29% and verbal ability and achievement have 62.5% of their variances in common. This indicates that there is plenty of room for a second predictor in predicting academic achievement or academic ability.

CHAPTER VI

STATISTICAL RESULTS AND INTERPRETATION

Hypothesis I

After scoring the Kuder Preference Record items in the manner which yielded the highest possible correlation between each item and average achievement, it was found that 84 items in the Vocational form and 71 items in the Personal form displayed correlations with average achievement which were significantly different than zero. In the factor analysis of the two correlation matrices, one for each of Kuder's inventories, the vectors of correlations between scores on the significantly-correlating items and scores on the Lorge-Thorndike Intelligence Tests - Nonverbal Battery became the first factors for each of the matrices according to the diagonal method of factoring. Each of these vectors was squared using matrix multiplication and subtracted from the appropriate correlation matrix to yield two residual matrices. Thus, the residual matrices contained inter-item correlations and correlations between items and average achievement from which variance in common with general intellectual ability had been removed. Each of these residual matrices was then submitted to the principal axes factoring technique. For the residual matrix containing items from the Vocational form, average achievement had a loading of .570 on the first factor and no loadings on any other factor above .185 among the 28 factors selected using the criterion that all factors

should have corresponding eigenvalues greater than 1.0. Similarly, for the residual matrix containing items from the Personal form, average achievement had a loading of .544 on the first factor and no loadings on any other factor above .172 among 24 factors selected using the above criterion. Furthermore, none of the items had a loading greater than that of average achievement on either of these first factors. On the basis of these results, rotation of the factor solutions was not considered necessary and the unrotated first factors from the principal axes factoring of the residual matrices were labelled academic-achievement motivation factors. The factor solutions for the correlation matrices based on the Vocational and Personal forms are summarized in Appendix B.

From the Vocational form, 34 items were selected for inclusion in the motivation scale on the basis that they had correlations with the second factor greater than .300. By coincidence, this is both the mean and median number of items that Kuder used to form his fifteen scales in the two forms of the Kuder Preference Record. Since his longest scale contains 51 items and a factor loading of .25 is within rounding distance of .3, it was decided to add items having factor loadings between .250 and .300 to the above 34 items to form a longer version of the scale. Twelve items were added in this manner yielding a longer-version scale containing 46 items. Similarly, two scales were extracted from the Personal form having 24 and 37 items, respectively. The particular items selected for these four scales including the manner in which they were scored are listed in Appendix C.

Table IV indicates that the derived scales each have relatively high correlations with average achievement and low correlations with the Lorge-Thorndike Intelligence Test - Nonverbal Battery which was used as the measure of general intellectual ability. The 46 items from the Vocational form yielded a correlation with average achievement which was significantly higher than the 34 items from the Vocational form. Similarly, a significant difference was found between the two correlations using the longer and shorter scales from the Personal form. However, significant differences were not obtained when the two longer or the two shorter scales were compared. With respect to the correlations between the derived scales and the Nonverbal Battery, the only significant difference obtained was between the two versions of the scale from the Vocational form. These results prevented the selection of a best scale according to the criteria set out in Hypothesis I.

The general trend of the results reported in Table IV, including the partial correlations, suggest that the longer scale from the Vocational form is probably the best scale. However, it should be noted that the correlations between scales from the two forms of the Kuder Preference Record are quite low. This suggests that, although the scales are measuring academic-achievement motivation as defined by this thesis, scales from the two different forms are measuring two different things. This supports the decision to delay selection of a best scale until later in the study. Therefore, the remaining hypotheses were tested using both of the scales from the Vocational form and the longer scale from the Personal form. The shorter scale from the Personal form

TABLE IV

CORRELATIONS FOR THE TENTATIVE ACADEMIC-ACHIEVEMENT ORIENTATION SCALES

VARIABLE	Vocational		Personal	
	Long	Short	Long	Short
Vocational-Long	1.000	.973	.294	.261
Vocational-Short	.973	1.000	.280	.250
Personal-Long	.294	.280	1.000	.926
Personal-Short	.261	.250	.926	1.000
Lorge-Thorndike Nonverbal	.284	.241	.325	.275
Lorge-Thorndike Verbal	.567[a]	.521[a]	.484[a,b]	.403[a,b]
Average Achievement	.631	.585	.583	.499
Mathematics	.496[a,b]	.457[a,b]	.517[a,b]	.468[a]
Science	.573[a,b]	.535[a]	.411[b]	.310[b]
Language	.480[a,b]	.447[a,b]	.554[a]	.495[a]
Literature	.508[a,b]	.457[a,b]	.575[a]	.497[a]
Social Studies	.646[a]	.606[a]	.450[b]	.380[b]

PARTIAL CORRELATIONS BETWEEN THE SCALES AND AVERAGE ACHIEVEMENT

Removing:				
Lorge-Thorndike Nonverbal	.592	.557	.512	.433
Lorge-Thorndike Verbal	.362	.331	.374	.322

a. significantly above the correlation with the Nonverbal Battery using a one-tailed test and the .05 level of probability.
b. significantly below the correlation with average achievement.

was eliminated on the basis that it appeared to be the poorest of the four scales and the possibility of choosing it as the best scale in the final analysis was quite remote.

Hypothesis II

The results of the statistical analyses for this hypothesis, also reported in Table IV, support the contention that the longer version of the scale taken from the Vocational form is probably the best of the derived scales since this scale comes closest to satisfying the expectancies of the hypothesis. The biggest question arising from these results concerns the slightly higher correlation between each of the scales from the Vocational form and Social Studies marks when compared to their correlations with average achievement. However, this is related to a bigger question which focuses on labelling the specific types of interests that can be employed in a measure of academic-achievement motivation, and which was considered beyond the scope of a study designed to statistically derive and evaluate the said measure.

Generally, it can be concluded that the derived scales, from the Vocational form at least, are related to achievement to a greater degree than to general intellectual ability, and that they tend to measure academic-achievement-in-general rather than specific areas of academic achievement.

Hypothesis III

The mean average-achievement scores for girls and boys were 50.6 and 49.2, 49.0 and 51.3, and 51.4 and 48.0 for Samples I, II and III, respectively. These differences were too small to be statistically

significant and the basic assumption underlying the hypothesis was thus refuted. Since no differences were found in achievement between the sexes, it was considered unnecessary to carry out the remainder of the calculations suggested by this hypothesis.

Hypothesis IV

Since Sample I contained only four students from Class 1 and five from Class 7, using Blishen's classification scheme, it was decided to pool these classes with Classes 2 and 6, respectively, before applying analysis of variance techniques to determine differences in average achievement when the sample was classified by socio-economic status. The number of individuals in each cell remained highly unequal even after taking this step with 47, 10, 20, 44, and 14 cases being observed in Classes 1-2, 3, 4, 5 and 6-7, respectively. When analysis of variance was applied to determine whether or not average achievement scores differed among these groups, no significant differences were found. However, the F-ratio was large enough to encourage further investigation in order to determine the effects of adjusting achievement scores to take into account the differences in scores obtained on the various derived scales. The use of analysis of covariance to adjust the achievement scores appeared to reduce the F-ratio appreciably. (Appendix D)

While the differences among groups were not significant, the means were generally in the expected rank order. The results of applying analysis of covariance to the achievement scores suggest that the hypothesis would have been confirmed if the underlying assumption

regarding the relation of Blishen's Occupational Rating Scale to achievement scores had not been refuted.

Hypothesis V

The correlations between each of the three derived scales and average achievement were found to be significantly higher than the correlation between average achievement and any one of Kuder's own scales for both boys and girls in Sample I. It should be obvious from Table V that such consistently satisfactory results were not obtained for Sample II or for the boys in Sample III. The hypothesized significant differences were obtained for the girls of Sample III, however, for both of the scales derived from the Vocational form in all cases except one. All comparisons were made after altering the correlations so that the correlation between each of Kuder's scales and average achievement became positive. This resulted in a nonsignificant difference being obtained for Sample III girls when comparing the correlation between the short version of the scale derived from the Vocational form and average achievement to the correlation between the Persuasive scale and average achievement.

For Sample I, then, the three possible scales which were derived from the Kuder Preference Records were all found to have higher correlations with average achievement than any one of Kuder's own scales. The results obtained from the application of the scales, derived on the basis of Sample I, to the other two samples suggest that items from the Kuder Preference Record - Vocational can be used to provide a better measure of academic-achievement orientation than that derived from

TABLE V

CORRELATIONS BETWEEN PREFERENCE SCALES
AND AVERAGE ACADEMIC ACHIEVEMENT

	SAMPLE I		SAMPLE II		SAMPLE III	
	Girls	Boys	Girls	Boys	Girls	Boys
Scales Derived in this Study						
Vocational-Long	.664	.602	.315	.422	.715	-.233
Vocational-Short	.631	.535	.394	.354	.639	.048
Personal-Long	.632	.610	.308	.294	.093	.045
Kuder Preference Record Scales						
0. Outdoor	.072	-.136	.257	-.003	.331	.300
1. Mechanical	.053	.055	.006	-.235	.073	-.070
2. Computational	.231	.224	-.031	.189	-.075	-.186
3. Scientific	.266	.083	-.040	-.088	.389	.230
4. Persuasive	-.204	-.158	-.261	.079	-.413	-.070
5. Artistic	-.218	-.143	.059	-.148	.291	-.003
6. Literary	.061	-.050	.298	.116	-.149	-.347
7. Musical	.115	.090	.350	.033	-.274	.137
8. Social Service	-.080	.081	.152	.117	.310	-.177
9. Clerical	-.150	.026	-.375	.041	-.352	-.201
A. Group Activity	-.170	-.102	-.223	-.019	.021	-.252
B. Stable Situations	-.080	.030	.097	.015	.018	-.013
C. Dealing with Ideas	.051	.190	.199	.293	.111	-.341
D. Avoiding Conflict	.059	.218	.368	.239	-.105	-.083
E. Directing Others	-.053	-.029	-.121	.042	-.239	-.367

items contained in the Kuder Preference Record - Personal in the sense that the latter scale did not hold up as well under cross-validation. It is possibly true that the degree to which original results were supported by the cross-validation samples was a function of the nature of the samples. Since some of the results were encouraging, it might be expected that cross-validation using a sample comparable to Sample I would yield correspondingly high correlation coefficients. The cross-validation section of this study suggests that it may be necessary to construct separate achievement-motivation scales for different levels of socio-economic status and for different levels of ability.

Conclusions

To summarize the statistical results reported in this chapter, the following observations may be reiterated:

1. Items from the Kuder Preference Records were identified which were used to form a scale that measured academic-achievement orientation.

2. The scales gain validity from the observation that they yielded better correlations with achievement than with general intellectual ability and tended to yield better correlations with academic-achievement-in-general than with achievement in specialized academic areas.

3. The scales developed from the Vocational form tended to provide a better measure of academic-achievement motivation than the scales developed from the Personal form.

4. No differences were found in average achievement when mean scores for sexes were compared. (Although it was not hypothesized or

reported earlier, it might be noted that girls scored significantly higher than did boys on the scale derived from the Personal form. The only significant differences in correlations between the proposed scales and average achievement occurred for Sample III when the scales from the Vocational form were used.)

5. No significant differences in average achievement were found when Sample I was grouped according to Blishen's occupational classification scheme. However, the trend of the differences was in the expected direction and appeared to be related to academic-achievement motivation as measured by the proposed scales.

6. Each of the three proposed scales yielded a correlation with average achievement which was significantly higher than the correlation between average achievement and any of Kuder's own scales when data from Sample I was used. This finding was confirmed for the scales derived from the Vocational form using data from the girls in Sample III but not for that from the boys. The results for Sample II were generally in the desired direction but not significant.

To supplement these results, a measure of internal consistency, reliability, was calculated for each of the possible scales yielding coefficients of .73 and .71 for the longer and shorter versions from the Vocational form, and .68 and .64 for the respective versions from the Personal form. The formula used was one which reduces to Kuder and Richardson's Formula 20 when items are scored dichotomously but which can be applied to situations in which items have more than two possible scores. This formula yields a value which "is a lower bound

to the reliability coefficient." (Gulliksen, 1965, pp. 223-224) These coefficients continued to favor selection of one of the scales from the Vocational form as the best measure of academic-achievement orientation. A review of all the findings indicated that very little difference exists between the longer and shorter versions of the scale derived from the Vocational form and that little would be gained by selecting one version rather than the other.

Perhaps the most important conclusion to be drawn from this study is that the results obtained suggest that further research involving the derivation of a scale from the Kuder Preference Record which is related to academic achievement is warranted. Suggestions in this respect are included in the following chapter.

CHAPTER VII

IMPLICATIONS

Since the conclusions for the study were often based on a preponderance of favorable tendencies or trends rather than statistically significant results in the hypothesized directions, the conclusions are only tentative, at best, and the general implication is that the obtained results favor further research along the lines established in this study. However, since it is anticipated that further research will confirm the hypotheses of this study and strengthen the conclusions which can be only tentative here, an outline of more specific implications for theory and practise as well as further research is warranted.

Implications for Theory and Practise

The main purpose of the study was to derive a scale which could be labelled academic-achievement orientation, and which would have a relatively high correlation with academic achievement. This was considered a useful endeavor in view of the commonly accepted concept of achievement as the result of a combination of ability and motivation. While the use of ability measures has become popular in both theory and practise, motivation measures do not appear to be satisfactorily integrated in the development of theory and are generally not employed in practical situations. It is suggested here that the proposed measure of academic-achievement motivation may be one which will enhance the

possibility of the concept of motivation being given equal status with the concept of ability in attempts to understand the contributing factors to individual differences in academic achievement.

Several implications for theory which arise from this study merit special attention. Most importantly, it was suggested earlier that the measurement of motivation for the prediction of a certain set of behaviors should probably focus on more general characteristics of the individual before attempting to determine the roots of these characteristics. The results of this study suggest that certain sets of interest preferences can be used as a measure of motivation which will be useful in predicting certain types of achievement. It is felt that a more integrated theory concerning the relationships of motivation to achievement may be obtained by studying motivation at the level of interest preferences before attempting to work at the level of need states. Once the relationships at this level have been reasonably well explored, the integration of need states may be more easily performed.

It was also suggested that academic-achievement motivation, like academic ability, would be heavily influenced by environment and past experiences. Although the Blishen Occupational Rating Scale, used as an index of environmental influences, yielded relatively small correlations of .21 and .20 with the two versions of the derived scale from the Vocational form, the proposed relationship should be further investigated since other indices of environmental influences may yield more significant results. It is still suggested, then, that the proposed measure of academic-achievement orientation may provide a useful link

in studying the relationships between individual differences in academic achievement and environmental influences.

While this study was primarily concerned with investigating the possibility of using interest-preference items as a measure of academic achievement motivation, the relationship between the derived scale and a number of other variables was also investigated. These peripheral investigations assumed an additive, linear relationship between various combinations of variables. The appropriateness of this assumption must be determined before an adequate theory of individual differences in achievement can be presented. For example, the assumption that achievement is the sum of ability and motivation is probably much too simple. The postulation of a more complex relationship between the two may have been able to account for some of the seemingly erratic results obtained in the study, e.g., the results obtained when the derived scale was applied to Sample III.

The main implication arising from the study with respect to practical application concerns the possibility that the proposed scale would prove to be a measure of academic-achievement motivation which would be accepted as a valuable instrument in guidance and counselling to be used in conjunction with measures of ability. This possibility depends, of course, on the results of further research involving the scale. However, the present study indicates that such a scale may be of value. Since the scale scores would be easily obtained once the Kuder Preference Record had been administered and since the Kuder Preference Record is one of the more popular interest inventories, the

possibility that the scale would be used in practical situations does not seem too remote. As mentioned earlier, this scale would have the advantage of being relatively easy to administer which is an advantage that is not possessed by some of the presently-considered best measures of achievement motivation.

Depending on the results of further research, the proposed scale would likely be of most practical value in the case of the commonly labelled underachievers and borderline students. With respect to the underachievers, the scale may prove useful in helping to determine appropriate corrective procedures to assist the student in performing at a higher level, i.e., the solution to the student's problem from the school's point of view may be an expansion of his field of interests or it may involve capitalizing on the specific interests that he does have. The scale may also prove useful in the guidance of borderline students whose past achievement suggests that they may be relatively poor risks for a certain program of further education but whose interests, as measured by the proposed scale, provide the additional information necessary to make a more suitable decision regarding their further education.

Implications for Research

Much of what has already been said in this chapter assumed that further research would endorse the proposed scale as a valid and reliable measure of academic-achievement motivation. Some of the more important and immediate investigations which should be carried out in order to facilitate the development of this scale are noted in the

following suggestions.

1. The major portion of this study should be replicated using a larger sample and standardized achievement tests, e.g., Government of Alberta Departmental Examinations, which would facilitate cross-validation of the scale across samples.

2. A more accurate measure of environmental influences should be included in future investigations. This may involve a combination of other measures with Blishen's scale, or possibly even an updating of Blishen's scale to make it more representative of the present occupational distribution of the population of Canada.

3. Scales should be derived using different grade levels and compared.

4. The predictive validity of the scale should be assessed when a number of years elapse between the time of administration of the interest inventory and that of the achievement test.

5. The predictive validity of the scale should be assessed for various levels of ability and socio-economic status.

6. An attempt should be made to identify the types of preferences that have been included in the scale.

7. The scale derived from the Kuder Preference Record - Vocational should be compared to that from the Personal form in order to determine the advantages of having one scale from one form, one scale that incorporates items from both forms, or two different scales from the two different forms.

8. The derived scale should be compared to the best weighting of

Kuder's scales in order to determine whether or not there is an advantage to having a separate scale rather than a weighting of the present scales. (This has been done for the samples of the present study and is reported in Appendix E.)

9. The derived scale should be compared to presently existing achievement motivation scales in order to determine whether or not one is better than the other or if they complement one another.

10. The effect of success or failure and perception of abilities on the development of academic-achievement motivation should be studied since the presence of such effects would influence the reliability of the scale.

REFERENCES

Abelson, R. P. Sex differences in predictability of college grades. Educational and Psychological Measurement, 1952, 12, 638-644.

Anastasi, A. Individual differences. New York: Wiley, 1965.

Atkinson, J. W., & Feather, N. T. A theory of achievement motivation. New York: Wiley, 1966.

Blishen, B. R. The construction and use of an occupational class scale. In B. R. Blishen, F. E. Jones, K. D. Naegele, & J. Porter (Ed.), Canadian society. Toronto: MacMillan, 1961. Pp. 477-485.

Bloom, B. S. Stability and change in human characteristics. New York: Wiley, 1964.

Bloom, B. S. Compensatory education for cultural deprivation. New York: Holt, Rinehart & Winston, 1965.

Cattell, R. B. Personality and motivation structure and measurement. New York: World Book, 1957.

Detchen, L. The effect of a measure of interest factors on the prediction of performance in a college social sciences comprehensive examination. Journal of Educational Psychology, 1946, 37, 45-52.

Draper, N. R., & Smith, H. Applied regression analysis. New York: Wiley, 1966.

Elley, W. B. Intelligence and socio-economic status. Unpublished doctoral disertation, University of Alberta, 1961.

Ferguson, G. A. Statistical analysis in psychology and education. (2nd ed.) New York: McGraw - Hill, 1966.

Ferguson, L. W. Personality measurement. New York: McGraw - Hill, 1952.

Fruchter, B. Introduction to factor analysis. Princeton: D. VanNostrand, 1954.

Greene, E. B. Measurements of human behavior. New York: Odyssey Press, 1952.

Gulliksen, H. Theory of mental tests. New York: Wiley, 1965.

Hale, P. P., & Leonard, R. J. The Kuder preference record and the professional curriculum. Journal of Educational Research, 1956, 50, 71-74.

Harmon, H. H. Modern factor analysis. (2nd ed.) Chicago: University of Chicago Press, 1967.

Heckhausen, H. The anatomy of achievement motivation. New York: Academic Press, 1967.

Henderson's Greater Edmonton Directory, Winnipeg: Henderson's Directories, 1963.

Herzberg, F., Bouton, A., & Steiner, B. J. Studies of the stability of the Kuder preference record. Educational and Psychological Measurement. 1954, 14, 90-100.

Horst, P. Factor analysis of data matrices. New York: Holt, Rinehart & Winston, 1965.

Horst, P. Psychological measurement and prediction. Belmont, California: Wadsworth Publishing Company, 1966.

Hunt, J. McV. Intelligence and experience. New York: Ronald Press, 1961.

Jackson, R. A. Prediction of the academic success of college freshmen. Journal of Educational Psychology, 1955, 46, 296-301.

Knapp, R. R. An empirical investigation of the concurrent and observational validity of an ipsative versus a normative measure of six interpersonal values. Educational and Psychological Measurement, 1964, 24, 65-73.

Kuder, G. F. Kuder preference record: Examiner manual, Vocational form C. Chicago: Science Research Associates, 1956.

Lavin, D. E. The prediction of academic performance. New York: Russel Sage Foundation, 1965.

Lorge, I., & Thorndike, R. L. The Lorge-Thorndike intelligence tests: Examiner manual, Level 4. Boston: Houghton Mifflin, 1957.

Lorge, I., & Thorndike, R. L. The Lorge-Thorndike intelligence tests: Technical manual. Boston: Houghton Mifflin, 1962.

MacArthur, R. S. Some differential abilities of northern Canadian native youth. International Journal of Psychology, 1968, 3, 43-51.

McClelland, D. C., Atkinson, J. W., Clark, R. A., & Lowell, E. L. The achievement motive. New York: Appleton-Century-Crofts, 1953.

McNemar, Q. Psychological statistics. New York: Wiley, 1962.

Mitchell, J. V. Jr. An analysis of the factorial dimensions of the achievement motivation construct. Journal of Educational Psychology, 1961, 52, 179-187.

O'Hara, R. P. Vocational self-concepts of boys choosing science and non-science careers. Educational and Psychological Measurement, 1967, 27, 139-149.

Phillips, W. S., & Osborne, R. T. A note on the relationship of the Kuder preference record scales to college marks, scholastic aptitude, and other variables. Educational and Psychological Measurement, 1949, 9, 331-337.

Rethlingshafer, D. Motivation as related to personality. New York: McGraw-Hill, 1963.

Romney, A. K. The Kuder literary scale as related to achievement in college English. Journal of Applied Psychology, 1950, 34, 40-41.

Rosenberg, N. Stability and maturation of Kuder interest patterns during high school. Educational and Psychological Measurement, 1953, 13, 449-458.

Shaw, M. C. Need achievement scales as predictors of academic success. Journal of Educational Psychology, 1961, 52, 282-285.

Skager, R., & Terwilliger, J. Nonintellective correlates of secondary school achievement. Research Bulletin, 1964, Princeton, Educational Testing Services.

Thomson, G. H. The factorial analysis of human ability. London: University of London Press, 1951.

Thorndike, R. L., & Hagen, E. Measurement and evaluation in psychology and education. (2nd ed.) New York: Wiley, 1961.

Triggs, F. O. A study of the relation of Kuder preference record scores to various other measures. Educational and Psychological Measurement, 1943, 3, 341-354.

Wahlstrom, M. W. Need for achievement and academic success. Unpublished master's thesis, University of Alberta, 1965.

Walker, H., & Lev, J. Elementary statistical methods. New York: Holt, Rinehart & Winston, 1958.

West, L. W. Intelligence and culture. Unpublished master's thesis, University of Alberta, 1962.

Winer, B. J. Statistical principles in experimental design. New York: McGraw-Hill, 1962.

APPENDIX A

KUDER PREFERENCE RECORD FACE SHEET

This blank is used for obtaining a record of your preferences. It is not a test. There are no right or wrong answers. An answer is right if it is true of you.

A number of activities are listed in groups of three. Read over the three activities in each group. Decide which of the three activities you like **most**. There are two circles on the same line as this activity. Punch a hole with the pin through the left-hand circle following this activity. Then decide which activity you like **least** and punch a hole through the right-hand circle of the two circles following this activity.

In the examples below, the person answering has indicated for the first group of three activities, that he would usually like to visit a **museum most**, and **browse** in a library **least**. In the second group of three activities he has indicated he would ordinarily like to collect autographs **most** and collect butterflies **least**.

EXAMPLES

Put your answers to these questions in column O.

		O
	Visit an art gallery	F
	Browse in a library	Q ← LEAST
	Visit a museum	MOST → R
	Collect autographs	MOST → S
	Collect coins	T
	Collect butterflies	U ← LEAST

Some of the activities involve preparation and training. In such cases, please suppose that you could first have the necessary training. Do not choose an activity merely because it is new or unusual. Choose what you would like to do if you were equally familiar with all of the activities.

In some cases you may like all three activities in a group. In other cases you may find all three activities unpleasant. Please show what your first and last choices would be, however, if you *had* to choose.

Some activities may seem trivial or foolish. Please indicate your choices, anyway, for all of the groups. Otherwise we cannot give you a complete report. Your answers will be kept strictly confidential.

Please do not spend a lot of time on one group. Put down your first reaction and go on. Do not discuss the activities with anyone. An answer is worthless unless it is your own judgment.

If you want to change an answer, punch two more holes close to the answer you wish to change; then punch the new answer in the usual way. Hold the pin straight up and down when you punch your answers.

Now go ahead with the activities on the next page.

Published By Science Research Associates, 57 W. Grand Avenue, Chicago 10, Illinois

Copyright 1948, by G. Frederic Kuder. Copyright under International Copyright Union.
All rights reserved under Fourth International American Convention (1910). Copyright 1948 in Canada.
Registered under Patent Nos. 1,500,777 and 2,052,369. Printed in the U.S.A.

Please use number 7 291 when reordering these stepdowns.

APPENDIX B

SUMMARY OF FACTOR SOLUTION USING VOCATIONAL ITEMS

Variables		Factor Loadings: Diagonal Factor	Factor Loadings: First P.A. Factor	Communalities: Two Factors	Communalities: Twenty-nine Factors
Nonverbal Battery		1.000	.000	1.000	1.000
Average Achievement		.480	.570	.555	.712
Kuder Preference Items[1]					
Page 1	ghj	.117	.354	.139	.796
	rst	-.002	.314	.099	.757
	xyz	-.058	.393	.158	.683
	ABC	.050	.291	.087	.729
	DEF	.025	.462	.214	.639
	GHJ	.192	.243	.096	.753
	KLM	.072	.325	.111	.836
	NPQ	-.020	.265	.071	.681
	RST	.104	.232	.065	.665
Page 2	ABC	.290	.156	.108	.789
	GHJ	-.024	.359	.129	.697
	KLM	.196	.188	.074	.685
	XYZ	.078	.157	.031	.715
	def	-.022	.410	.169	.768
	ghj	.024	.184	.034	.742
	klm	.167	.166	.055	.789
	rst	.117	.308	.109	.794
Page 3	ABC	.208	.198	.082	.694
	KLM	.214	.199	.085	.720
	RST	.054	.308	.098	.782
Page 4	ABC	.104	.107	.022	.729
	GHJ	.142	.208	.063	.780
	NPQ	.010	.222	.049	.731
	XYZ	.226	.451	.254	.747
	abc	.176	.020	.031	.740
	ghj	.025	.267	.072	.699
	rst	.236	.238	.112	.630

Appendix B continued

Variables		Factor Loadings: Diagonal Factor	Factor Loadings: First P.A. Factor	Communalities: Two Factors	Communalities: Twenty-nine Factors
Kuder Preference Items[1]					
Page 5	ghj	.111	.265	.083	.638
	klm	.277	.164	.104	.754
	npq	.078	.396	.163	.742
	DEF	.138	.125	.036	.711
	GHJ	.053	.058	.006	.724
	KLM	.017	.387	.150	.657
	RST	.067	.151	.027	.710
Page 6	GHJ	.134	.320	.120	.745
	KLM	.003	.228	.052	.667
	RST	.109	.418	.187	.656
	def	.104	.285	.092	.796
	npq	.134	.145	.039	.764
	rst	.075	.244	.065	.763
Page 7	def	-.061	.350	.126	.671
	klm	.237	.130	.073	.795
	npq	-.006	.303	.092	.799
	uvw	.112	.241	.071	.767
	xyz	.018	.266	.071	.803
	ABC	.069	.430	.190	.755
	GHJ	.050	.282	.082	.653
	KLM	.125	.264	.085	.684
	RST	.085	.433	.195	.764
Page 8	GHJ	.161	.341	.142	.715
	KLM	.014	.401	.161	.695
	UVW	.042	.220	.050	.652
	abc	-.090	.225	.059	.719
	def	.193	.172	.067	.754
	klm	.110	.357	.140	.759
Page 9	def	.245	.072	.065	.740
	npq	.146	.495	.266	.775
	uvw	.172	.365	.163	.714
	xyz	.055	.480	.233	.776
	ABC	.115	.339	.128	.803
	NPQ	.084	.173	.037	.744

Appendix B continued

Variables		Factor Loadings: Diagonal Factor	Factor Loadings: First P.A. Factor	Communalities: Two Factors	Communalities: Twenty-nine Factors
Kuder Preference Items[1]					
Page 10	DEF	.171	.142	.049	.749
	KLM	.059	.205	.046	.732
	XYZ	.056	.219	.051	.753
	ghj	.079	.241	.064	.792
	npq	.086	.321	.110	.719
	rst	.003	.293	.086	.782
Page 11	abc	.091	.208	.052	.770
	ghj	-.006	.500	.250	.765
	npq	.151	.397	.180	.761
	rst	.090	.220	.057	.708
	uvw	.103	.328	.118	.738
	ABC	.084	.221	.056	.734
	DEF	-.061	.372	.142	.753
	KLM	.008	.176	.031	.609
	RST	.119	.281	.093	.766
Page 12	ABC	.082	.387	.156	.754
	DEF	.156	.259	.091	.742
	RST	-.142	.327	.127	.792
	XYZ	.101	.381	.155	.713
	abc	-.081	.240	.064	.672
	def	.143	.223	.070	.787
	klm	.001	.337	.114	.605
	npq	.051	.286	.084	.679

1. The vocational items are those contained in the Kuder Preference Record - Vocational, Form C, while the personal items--in the remainder of the appendix--are those in the Kuder Preference Record - Personal, Form A.

   The pages listed are those on which the particular items are found in the appropriate form of the Kuder Preference Record, while the letters are those used to indicate the three choices of a given item on the specified page.

Appendix B continued

SUMMARY OF FACTOR SOLUTION USING PERSONAL ITEMS

Variables		Factor Loadings: Diagonal Factor	Factor Loadings: First P.A. Factor	Communalities: Two Factors	Communalities: Twenty-five Factors
Nonverbal Battery		1.000	.000	1.000	1.000
Average Achievement		.480	.544	.526	.670
Kuder Preference Items					
Page 1	xyz	.014	.048	.003	.684
	DEF	.114	.187	.048	.733
	GHJ	.168	.194	.066	.701
	RST	-.003	.239	.057	.704
Page 2	DEF	-.020	.320	.103	.657
	GHJ	.107	.254	.076	.742
	KLM	.115	.305	.106	.784
	RST	.135	.271	.092	.685
	XYZ	.084	.275	.083	.579
	def	.160	.364	.158	.716
	ghj	.036	.373	.140	.657
	klm	.153	.001	.023	.660
	npq	.165	.201	.068	.762
Page 3	klm	.079	.068	.010	.648
	npq	.167	.214	.074	.733
	uvw	.058	.345	.122	.650
	ABC	.089	.135	.026	.744
	DEF	.033	.186	.036	.634
	RST	.155	.094	.033	.793
Page 4	NPQ	.169	.197	.067	.714
	RST	.055	.185	.037	.631
	XYZ	.091	.291	.093	.676
	ghj	.157	.168	.053	.732
	npq	.050	.333	.113	.759
	rst	.140	.103	.030	.687
Page 5	rst	.150	.274	.098	.741
	xyz	.014	.379	.144	.713

Appendix B continued

Variables		Factor Loadings: Diagonal Factor	Factor Loadings: First P.A. Factor	Communalities: Two Factors	Communalities: Twenty-five Factors
Kuder Preference Items					
Page 6	GHJ	.183	.361	.164	.721
	KLM	.085	.246	.068	.707
	RST	.082	.302	.098	.686
	UVW	.120	.252	.078	.773
	XYZ	.077	.490	.246	.628
	abc	.041	.351	.125	.701
	def	.250	.192	.099	.646
	npq	.152	.363	.155	.733
Page 7	def	.106	.010	.011	.667
	npq	.032	.315	.100	.676
	rst	.070	.179	.037	.773
	DEF	.182	.165	.060	.623
	GHJ	.044	.071	.007	.744
	NPQ	.154	.254	.088	.762
	RST	.148	.257	.088	.713
Page 8	ABC	.114	.459	.224	.685
	GHJ	.112	.244	.072	.722
	UVW	.018	.298	.089	.712
	XYZ	.066	.016	.005	.708
	def	.138	.023	.020	.675
	ghj	.023	.194	.038	.614
	npq	.078	.313	.104	.632
Page 9	abc	.167	.309	.123	.671
	ghj	.171	.053	.032	.610
	rst	.166	.048	.030	.720
	uvw	.027	.222	.050	.727
	DEF	.050	.299	.092	.712
	GHJ	.146	.396	.178	.692

Appendix B continued

Variables		Factor Loadings: Diagonal Factor	Factor Loadings: First P.A. Factor	Communalities: Two Factors	Communalities: Twenty-five Factors
Kuder Preference Items					
Page 10	KLM	.059	.279	.081	.709
	NPQ	.091	.268	.080	.712
	RST	.074	.158	.030	.716
	UVW	.188	.192	.072	.736
	abc	.098	.366	.144	.742
	def	.131	.459	.228	.733
	klm	.157	.281	.104	.696
	npq	.103	.058	.014	.662
Page 11	klm	.110	.315	.111	.623
	npq	.122	.336	.128	.657
	DEF	.129	.393	.171	.683
	KLM	.030	.428	.184	.686
Page 12	ABC	.039	.218	.049	.726
	KLM	.113	.027	.013	.593
	XYZ	.117	.244	.073	.737
	rst	.110	.470	.233	.750

APPENDIX C

SCORING KEYS FOR DERIVED SCALES

Vocational Items[a]

Page 1				
	most g	least h	least j	
	least r	most s	least t	
	least x	most y	most z	
	most A	most B	least C	*
	most D	most E	least F	
	least K	most L	most M	
	most N	most P	least Q	*
Page 2				
	least G	most H	least J	
	most d	least e	least f	
	least r	most s	least t	
Page 3				
	most R	least S	least T	
Page 4				
	least X	most Y	most Z	
	most g	least h	least j	*
Page 5				
	most g	least h	least j	*
	least n	least p	most q	
	least K	most L	most M	
Page 6				
	least G	most H	least J	
	most R	least S	most T	
	least d	most e	most f	*

Appendix C continued

Page 7

most	d	most	e	least	f	
least	n	most	p	most	q	
most	x	most	y	least	z	*
most	A	least	B	most	C	
most	G	least	H	least	J	*
least	K	most	L	least	M	*
least	R	most	S	least	T	

Page 8

most	G	least	H	most	J	
least	K	most	L	least	M	
most	k	least	l	least	m	

Page 9

most	n	least	p	least	q	
most	u	most	v	least	w	
most	x	most	y	least	z	
most	A	most	B	least	C	

Page 10

least	n	most	p	most	q	
most	r	least	s	least	t	*

Page 11

most	g	most	h	least	j	
least	n	most	p	least	q	
most	u	most	v	least	w	
most	D	least	E	least	F	
most	R	least	S	most	T	*

Page 12

least	A	most	B	least	C	
least	D	most	E	least	F	*
least	R	most	S	least	T	
least	X	least	Y	most	Z	
most	k	least	l	most	m	
least	n	most	p	most	q	*

[illegible]

[illegible]

[illegible]

Appendix C continued

Personal Items[a]

Page 2						
	most	D	least	E	least	F	
	most	G	most	H	least	J	*
	least	K	most	L	least	M	
	least	R	most	S	least	T	*
	most	X	most	Y	least	Z	*
	most	d	most	e	least	f	
	most	g	most	h	least	j	
Page 3						
	least	u	most	v	least	w	
Page 4						
	least	X	most	Y	most	Z	*
	most	n	least	p	most	q	
Page 5						
	most	r	least	s	most	t	*
	most	x	least	y	most	z	
Page 6						
	most	G	least	H	most	J	
	least	R	most	S	most	T	
	most	U	most	V	least	W	*
	most	X	least	Y	least	Z	
	least	a	most	b	least	c	
	most	n	least	p	least	q	
Page 7						
	least	n	most	p	most	q	
	most	N	least	P	most	Q	*
	most	R	most	S	least	T	*
Page 8						
	least	A	most	B	least	C	
	least	U	most	V	least	W	*
	most	n	most	p	least	q	
Page 9						
	most	a	least	b	least	c	
	least	D	most	E	least	F	*
	most	G	most	H	least	J	

Appendix C continued

Page 10

most	K	most	L	least	M *
most	N	least	P	least	Q *
least	a	most	b	least	c
most	d	most	e	least	f
most	k	least	l	least	m *

Page 11

most	k	least	l	most	m
most	n	least	p	most	q
most	D	least	E	least	F
least	K	most	L	most	M

Page 12

most	r	least	s	most	t

a. The vocational items are those contained in the Kuder Preference Record - Vocational, Form C, while the personal items are those in the Kuder Preference Record - Personal, Form A.
The pages listed are those on which the particular items are found in the appropriate form of the Kuder Preference Record, while the letters in a given row are the letters corresponding to the three choices of one of the items on the specified page.
"Least" and "most" indicate the preference that must be indicated by an individual in order to obtain a point for that choice in the given item.

* These items were the ones added to the shorter derived scale in order to form the longer version of the scale.

Item 10

Item 11

Item 12

8. The remaining items are those contained in the Query Properties Sheet - Tabulated Query. Only the Query Type and Query Name are mandatory items for Query Definition. The Query Name is entered in the Query Name box at the top of the Query Properties Sheet.

9. Those items with the name Query in the Query Definition table are entered on the Query Properties Sheet.

APPENDIX D

ANALYSIS OF COVARIANCE

CRITERION: Average Achievement
COVARIATE: Long Version of Derived Scale from Vocational Form
GROUP: Blishen's Occupational Classes

CLASS	NUMBER OF CASES	COVARIATE MEAN	CRITERION MEAN	ADJUSTED MEAN
1-2	47	56.3	50.4	49.5
3	10	55.7	53.0	52.4
4	19	56.3	52.6	51.7
5	44	52.9	49.1	50.0
6-7	13	50.5	44.5	46.6

ANALYSIS OF VARIANCE ON COVARIATE:

SOURCE	DF	MS	F	P
Groups	4	133.33	1.268	.286
Error	128	105.11		

ANALYSIS OF VARIANCE ON CRITERION:

SOURCE	DF	MS	F	P
Groups	4	161.39	2.218	.071
Error	128	72.75		

ANALYSIS OF COVARIANCE

SOURCE	DF	MS	F	P
Groups	4	67.25	1.493	.208
Error	127	45.05		

Appendix D continued

ANALYSIS OF COVARIANCE

CRITERION: Average Achievement
COVARIATE: Short Version of Derived Scale from Vocational Form
GROUPS: Blishen's Occupational Classes

CLASS	NUMBER OF CASES	COVARIATE MEAN	CRITERION MEAN	ADJUSTED MEAN
1-2	47	42.0	50.4	49.6
3	10	41.7	53.0	52.4
4	19	42.2	52.6	51.7
5	44	39.0	49.1	50.0
6-7	13	37.8	44.5	46.2

ANALYSIS OF VARIANCE ON COVARIATE:

SOURCE	DF	MS	F	P
Groups	4	90.28	1.284	.280
Error	128	70.30		

ANALYSIS OF VARIANCE ON CRITERION:

SOURCE	DF	MS	F	P
Groups	4	161.39	2.218	.071
Error	128	72.75		

ANALYSIS OF COVARIANCE:

SOURCE	DF	MS	F	P
Groups	4	72.32	1.530	.197
Error	127	49.24		

Appendix D continued

ANALYSIS OF COVARIANCE

CRITERION: Average Achievement
COVARIATE: Long Version of Derived Scale from Personal Form
GROUPS: Blishen's Occupational Classes

CLASS	NUMBER OF CASES	COVARIATE MEAN	CRITERION MEAN	ADJUSTED MEAN
1-2	47	46.8	50.4	50.4
3	9	49.2	53.6	52.3
4	20	49.1	51.8	50.5
5	44	46.7	49.1	49.2
6-7	14	42.6	45.1	47.4

ANALYSIS OF VARIANCE ON COVARIATE:

SOURCE	DF	MS	F	P
Groups	4	102.25	1.271	.285
Error	129	80.46		

ANALYSIS OF VARIANCE ON CRITERION:

SOURCE	DF	MS	F	P
Groups	4	139.42	1.877	.118
Error	129	74.30		

ADJUSTED ANALYSIS OF VARIANCE

SOURCE	DF	MS	F	P
Groups	4	44.76	.878	.479
Error	128	50.95		

Note: The number of cases in each group vary between tables based on the Vocational and Personal forms because of missing data.

APPENDIX E

COMPARISON OF DERIVED SCALES TO
BEST WEIGHTING OF KUDER'S SCALES

STANDARD WEIGHTS FOR KUDER'S SCALES

SCALE	SAMPLE I Boys	SAMPLE I Girls	SAMPLE II Boys	SAMPLE II Girls	SAMPLE III Boys[1]	SAMPLE III Girls
0. Outdoor	-.187	-.246	.675	1.195		.129
1. Mechanical	.185	-.100	.093	.618	-.792	-.172
2. Computational	.142	.038	.034	-.315		.435
3. Scientific	-.097	-.038	-.307	.924		.889
4. Persuasive	-.266	-.426	-.057	.879		.383
5. Artistic	-.135	-.482	-.198	1.410		.756
6. Literary	.011	-.082	.091	1.252	-.483	.135
7. Musical	.143	-.101	-.055	1.034	.368	.205
8. Social Service	.061	-.496	-.222	1.328		.631
9. Clerical	-.080	-.454	.054	.995		.191
A. Group Activity	-.127	-.213	-.050	.262	-.779	.340
B. Stable Situations	-.125	-.299	-.712	.343		.117
C. Dealing with Ideas	.110	.163	.578	.020	-.538	.210
D. Avoiding Conflict	.283	.258	.425	.123		-.149
E. Directing Others	.028	-.048	-.099	.373	-.434	-.298
MULTIPLE CORRELATION WITH ACHIEVEMENT						
Fifteen Scales	.476	.588	.525	.825	.902	.759
Corrected for Shrinkage[2]	.103	.415	.000	.602	.866	.391
Two Derived Scales	.708	.804	.473	.361	.254	.724
Corrected for Shrinkage	.702	.797	.445	.314	.124	.712

1. The small sample size of Sample III Boys yielded redundancy in the data such that only six scales were needed to yield an almost perfect multiple correlation with achievement.

2. For formula used see McNemar, 1962, pp. 184-185.

Appendix E continued

For Sample I, the sample on which the two derived scales were based, a best weighting of Kuder's fifteen scales did not provide a measure which correlated with achievement as well as the best weighting of the two derived scales from the two forms of the interest inventory. Relatively inconsistent results were obtained for the other two samples. However, it must be pointed out that the multiple correlations between the fifteen scales and achievement were based on the best weighting of the scales for each sample rather than on the weights obtained from Sample I. Inspection of the weights for each sample would suggest that the multiple correlations obtained for Samples II and III would be much lower if they were based on the weights obtained for Sample I. Similarly, a much higher correlation could be expected between the derived scales and achievement for the two secondary samples if the scales were derived from information available for these two samples.

Since the correction for shrinkage reduced the multiple correlation between the fifteen scales and average achievement to a marked degree, the possibility of reducing the number of scales used to calculate the multiple correlation was considered. However, there was only one of Kuder's scales, at most, which predicted average achievement significantly and the particular scale varied from sample to sample--the Scientific scale for Sample I girls, the Clerical scale for Sample II girls, and the Persuasive scale for Sample III girls. It was concluded that there would not be a single set of scales which

yield a better multiple correlation than that obtained from the fifteen scales.

Inspection of the first order correlations between the derived scales and average achievement also suggests that each of the derived scales may provide a better correlation than that obtained from the best weighting of the fifteen scales especially if one set of weights for these scales is selected and applied to all samples.

With respect to this study, it can be concluded that a derived scale, possibly a derived scale from the Vocational form to be more specific, will provide the best measure of interests related to academic achievement. Thus, the addition of an academic-achievement orientation scale to the Kuder Preference Record appears to be warranted--at least as a means of obtaining more information from the Kuder Preference Record.

B29898